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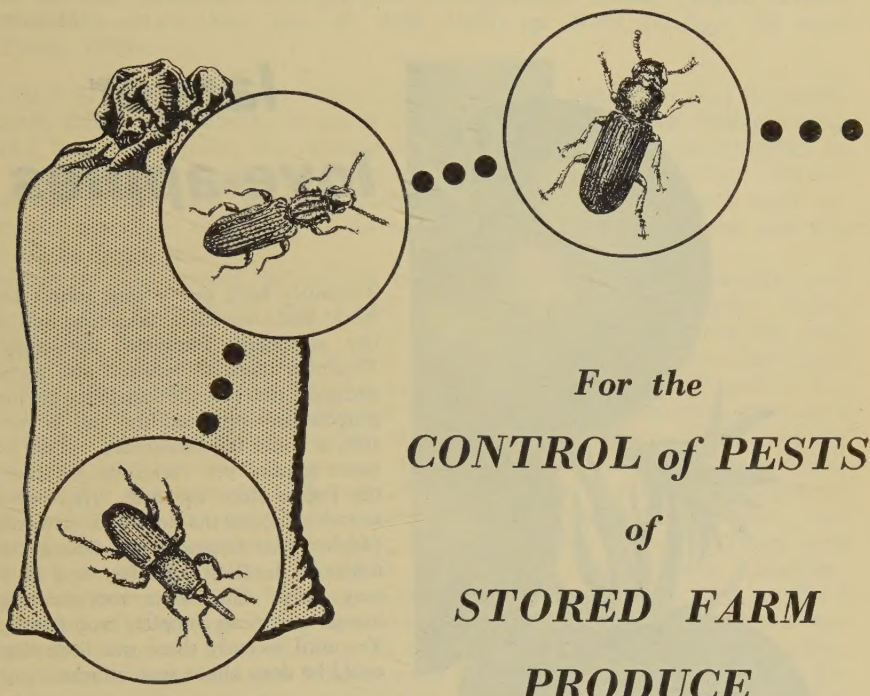

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KASHEF (A.). **Étude biologique de** *Stegobium paniceum* **L. (Col. Anobiidae) et de son parasite:** *Lariophagus distinguendus* **Först. (Hym. Pteromalidae).**—*Ann. Soc. ent. Fr.* **124** (1955) pp. 5–88, 63 figs., 51 refs. Paris, 1956.

In view of the difficulty of controlling *Stegobium paniceum* (L.) in stored products and the possibility of using its parasite, *Lariophagus distinguendus* (Först.) for the purpose, the bionomics of both insects were investigated in the laboratory at Paris, the rearing material originating from French Equatorial Africa. All stages of both species and the techniques used are described, and lists are given of the natural enemies of *Stegobium* and the hosts of *Lariophagus*.

Stegobium was reared on several cereal products (wheat, semolina and rice) and the egg, larval and pupal stages averaged 9, 57 and 9 days, respectively, at 24°C. [75·2°F.] and 45 per cent. relative humidity and 14, 104 and 15 days at 19°C. [66·2°F.] and 35 per cent. relative humidity. The adults remained in the cocoons for 7–9 and 8–12 days at 24 and 19°C., respectively, before emerging, and did not feed. Pairing occurred soon after emergence, and oviposition began about two days later. Eggs laid by unfertilised females did not hatch. At 24°C., males and females survived for respective averages of 17·6 and 28·6 days. The speed of development at 25°C. [77°F.] increased with relative humidity up to 70 per cent., but many of the larvae reared at higher humidities were killed by fungi that developed in the cultures. At 24°C. and 45 per cent. relative humidity, fertilised females laid 23–114 eggs each, with an average of 58·9, in 6–12 days, most of the eggs being laid during the first few days. When the males were removed after the second day on which the females oviposited, the numbers of eggs laid per female were 10–78 and averaged 47·9, but the reduction was not significant. At 35, 38 and 40°C. [95, 100·4 and 104°F.] and 80 per cent. relative humidity, females laid averages of 10·1, 3·8 and 0 eggs each, and at 15, 12 and 10°C. [59, 53·6 and 50°F.] and the same relative humidity, they laid averages of 21·3, 2·8 and 1·1. When females were kept at 24°C. for the first three days of oviposition, at 34°C. [93·2°F.] for the following three days, and then again at 24°C., the relative humidity remaining at 45 per cent., the daily average numbers of eggs laid per female during the three periods were 7·4, 1·4 and (for three days) 7·6, respectively.

Females of *L. distinguendus* began to oviposit immediately after pairing, attacking the cocoons. In the presence of cocoons containing full-fed larvae, prepupae or pupae of *Stegobium*, most oviposited in those containing prepupae, though some of the larvae and pupae were also parasitised. No eggs were laid on prepupae removed from their cocoons, and very few on those provided with false cocoons of filter paper. Parasitised hosts died in 1–2 days. Usually only one egg or larva was found per host, but superparasitism occurred when hosts were scarce, and the parasite larvae then attacked one another. At 24°C. and 45 per cent. relative humidity, the larvae hatched in 1–2 days, fed externally on the host and pupated after about eight days, the pupal stage lasting about 12 days. Adult females survived for 11–18 and 12–21 days and laid averages of 45·5 and 60·5 eggs each when provided with cultures of *S. paniceum* in semolina and rice, respectively, as compared with 22–30 days and 164 eggs each when adequate numbers of cocoons were provided in petri dishes, and it is concluded that fecundity varies with the ease of encountering hosts. Unfertilised females gave rise to males only. The adults survived for a maximum of only 15 days without food at 24°C. and 45 per cent. relative humidity, but as some lived for 30 days in the oviposition experiments, it is thought that they may feed on fine particles of the cereal or other products with which their hosts are associated. The

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ratio of males to females was 1:1·74, and full-fed larvae and prepupae of *Ptinus tectus* Boield. were readily parasitised in the laboratory.

Laudani (H.), Clark (P. H.), Williams (H. L.) & Dale (W. E.). **Insect Control on Feathers with EQ 53.**—*Soap & chem. Spec.* **31** no. 12 pp. 199, 201, 203–204, 225, 227, 4 refs. New York, N.Y., 1955.

The extent of the damage done to feathers by the larvae of *Attagenus megatoma* (F.) (*piceus* (Ol.)) under controlled conditions and the protection given by DDT deposits were investigated in Georgia. Samples of untreated duck, goose and chicken feathers and down, exposed to ten larvae, 3–5 months old, for 28 days at temperatures of 78–82°F. and 55–65 per cent. relative humidity, all showed heavy damage, with the production of 1·98–3·68 mg. excreta per larva by the end of the period. When feathers and down were treated with DDT to give deposits of 0·19, 0·36, 0·42 and 0·61 per cent. by weight and exposed in the same way after intervals of 6–54 months, all treatments resulted in 0·09–0·21 mg. excreta per larva, whereas untreated feathers showed 1·12–1·92 mg. As weights of excreta below 0·3 mg. per larva are considered to indicate satisfactory control, it appeared that DDT deposits of 0·19 per cent. by weight would suffice.

Methods and rates of application of the insecticide that would provide the requisite deposit were then sought, and two series of tests were made with dilute non-ionic emulsions containing various concentrations of DDT prepared from EQ-53, a moth-proofing preparation containing 25 per cent. DDT, 10 per cent. non-ionic emulsifier of the polyhydric alcohol or alcohol ether type and 65 per cent. aromatic hydrocarbon solvent, applied by immersion to the unwashed feathers or after washing or washing and rinsing. The feathers retained considerably more DDT than was expected from the amount of emulsion taken up, and the difference between the expected and actual deposits was progressively greater as the concentration of DDT in the bath was reduced. About the same amount of DDT was deposited on the feathers regardless of the type of treatment used or of whether the feathers were washed or not [*cf. R.A.E.*, A **44** 34], and the required deposit of 0·25–0·75 per cent. DDT was given by the use of 0·005–0·01 gm. DDT per gm. feathers (10·1–20·2 ml. EQ-53 per lb.).

The same treatment with EQ-53 proved satisfactory under practical conditions. The feathers are normally rinsed for 20 minutes after washing, and the addition of 0·5 fl. oz. EQ-53 per lb. of feathers to the rinsing water, at the end of rinsing, and agitating for five minutes gave satisfactory deposits on duck and goose feathers of all sizes, the smaller feathers and downs picking up proportionately more DDT than the larger feathers.

Smith (R. H.). *Lyctus* **Powder-post Beetle Control by Surface Applications of Oil Preparations and Solvents.**—*Pest Control* **24** no. 4 pp. 42, 45, 3 figs. Painesville, Ohio, 1956.

Preliminary experiments were carried out for two years in California on the control of *Lyctus planicollis* Lec., which attacks the sapwood of seasoned ring-porous hardwoods. Short lengths of red-oak branches, halved longitudinally, freed from the bark and seasoned to a moisture content of 12 per cent., were exposed to attack in the laboratory. Ten months later, when most of the larvae were well developed, the wood was cut into pieces 6 ins. long and the test materials were brushed over the flat surfaces once or three times, at intervals of 24 hours, from which they had to penetrate through 0·75–1·5 ins. of wood to reach the larvae; these were concentrated just below

the curved surfaces. The results were estimated from the numbers of adults emerging during the next three months, when emergence was complete, and were fairly consistent in all tests. In general, Velsicol AR-50 [mono- and dimethylnaphthalenes] and trichlorobenzene were the most and 5 per cent. pentachlorophenol, 2 per cent. copper naphthenate and xylene the least effective of the eight oil preparations and solvents used. Except in the case of the least successful materials, the addition of 2·5 per cent. DDT did not improve control, whereas increasing the number of applications caused a significant improvement.

Wolcott (G. N.). **Organic Termite Repellents tested against** *Cryptotermes brevis* **Walker.**—*J. Agric. Univ. P.R.* **39** no. 3 pp. 115–149, 2 figs., 4 refs. Río Piedras, P.R., 1955. (With a Summary in Spanish.)

Tests on the use of organic chemicals to protect wood against attack by *Cryptotermes brevis* (Wlk.) have been in progress in Porto Rico since January 1944 [*cf. R.A.E.*, A **41** 369, etc.]. Samples of *Bursera simaruba*, which is very susceptible to attack, and later of *Poinciana* (*Delonix*) *regia*, which is even more so, were submerged in the liquids for ten minutes and allowed to dry, and then exposed to the termites at intervals to find the length of time for which they were protected. Initial impregnations were usually made with 0·05–2 per cent. solutions, and the author lists the satisfactory materials and concentrations, with the periods for which they had been tested. Effective treatments, with the numbers of years of test in parentheses, include 2 per cent. DDT (10·5), 1 per cent. pentachlorophenol (11), pyridyl mercuric stearate (9) or tectoquinone (β-methylanthraquinone) (9), 0·5 per cent. sodium pentachlorophenate (8), 0·2 per cent. copper pentachlorophenate (9), pyridyl mercuric chloride (9), 1,1-bis(p-chlorophenyl)-2-nitrobutane (4·5), vulpinic acid (lichen acid) (3) or 2,4-dichlorostilbene (2·5), 0·1 per cent. 1,1-bis(4-hydroxy-2-methyl-5-isopropylphenyl)-2,2,2-trichloroethane (less than 2), 0·05 per cent. methoxy-DDT (methoxychlor), isodrin or endrin (nearly 5) [*cf.* **39** 322], 0·05 per cent. taxifolin (3·5) or 2,3,4,5-tetrachlorobenzoic acid (2·5), 0·01 per cent. pinosylvin monomethyl ether (4·5) or 1,1-bis(4-hydroxy-2-methyl-5-chlorophenyl)-2,2,2-trichloroethane (2·25), and 0·005 per cent. 2,4-dinitro-2′,4′-dichlorostilbene or 4,4′-dinitrostilbene (4·5). Ryanodine [**41** 370] gave almost complete protection for five years at 0·05 per cent., and 17 other compounds at 1 per cent. and 17 at 0·5 per cent. had remained effective for 2–8 years.

Kramer (M.). **A possibilidade de contrôle das doenças de virus do tomateiro por inseticida sistêmico.** [The Possibility of Control of Virus Diseases of Tomato by a systemic Insecticide.]—*Biológico* **22** no. 10 pp. 177–181, 1 fig., 7 refs. São Paulo, 1956.

In March–May 1956, tests were carried out in São Paulo with Am. Cyanamid 3911 (O,O-diethyl S-ethylthiomethyl phosphorodithioate), formulated as a 50 per cent. dust on activated carbon, for the protection of tomato plants from virus diseases, particularly spotted wilt, curly top and mosaics, which are transmitted by thrips, Cicadellids and Aphids, respectively. Two varieties of tomato were sown in boxes on 7th March, transferred to a field nursery on 23rd March and finally transplanted on 14th–16th April. The dust was mixed with the seeds before sowing, at the rate of 1:50 by weight, and applied (in talc) to the soil in the rows before pricking out and before transplanting, at about 1·69 lb. per acre. The

percentages of plants found infected by virus diseases on 25th April and 3rd and 13th May were 1·8, 5 and 9·3, respectively, for one variety and 0, 3·1 and 6·8 for the other, as compared with 11·9, 18·3 and 23·8, and 3·3, 11·6 and 25, respectively, for no treatment. The differences were highly significant on all three dates for the first variety, and not significant, significant and highly significant, respectively, for the second.

Miller (D.). **Bibliography of New Zealand Entomology 1775–1952 (with Annotations).**—*Bull. N.Z. Dep. sci. industr. Res.* no. 120, 10 × 6¼ ins., xxiv + 492 pp., 1 map. [Wellington, N.Z.] 1956. Price £1.

The main section of this bibliography is arranged under authors and comprises some 3,400 references dating from the first record of insects in New Zealand by Fabricius in 1775 down to 1952, though a few from 1953 are also included. The species or groups of insects concerned are indicated in most cases, and libraries in New Zealand or elsewhere in which the originals are available are listed. This is followed by a subject index in which references to the main list are classified under 11 main headings with subdivisions. One of the subdivisions under the heading of applied entomology is a list of insect pests, with their New Zealand references.

Miller (L. A.). **Notes on Life-history and Habits of the Squash Vine Borer, *Melittia cucurbitae* (Harr.) (Lepidoptera: Aegeriidae), in south-western Ontario.**—*Canad. J. agric. Sci.* **35** no. 6 pp. 533–537, 1 pl., 7 refs. Ottawa, 1955.

Observations were made during 1951–53 on the bionomics of *Melittia cucurbitae* (Harr.), a serious pest of squash and pumpkin in south-western Ontario. Adult emergence began during the last week of June and was usually complete by mid-July; pairing and oviposition occurred within a few days. Eggs were laid singly or in clusters and mostly on the stems. The average number per female was 96, and 89 per cent. were deposited during the first three days of oviposition; 90 per cent. of the eggs were viable, but those laid by unfertilised females did not hatch. In the field, oviposition was mainly completed by mid-July, though eggs were laid sporadically until mid-August. Males and females survived for 1–8 and 2–10 days, respectively. The larvae hatched in an average of nine days, bored into the stems, usually near the base, causing the plants to wilt or die, and became full-fed in 16–47 days, with an average of 29·7 days. They were present in the vines from 4th July until early October, and overwintered in cocoons in the soil at a depth of 1–6 ins. Pupation took place in spring and early summer, and the adults emerged readily from cocoons that had been exposed by cultural operations. In 1953, the emergence of a few adults was delayed until August–September, and in both 1952 and 1953 adults of a partial second generation appeared in late August and September; these late emerging individuals were of little importance.

Harcourt (D. G.) & Cass (L. M.). **Studies on Control of Caterpillars on Cabbage in the Ottawa Valley, 1953–1954.**—*Canad. J. agric. Sci.* **35** no. 6 pp. 568–572, 8 refs. Ottawa, 1955.

Pieris rapae (L.), *Plutella maculipennis* (Curt.) and *Trichoplusia ni* (Hb.) on late cabbages in eastern Canada were readily controlled in 1947–50 by four applications of a 3 per cent. DDT dust in July and August [*cf. R.A.E.*,

A **42** 52], but in view of reports elsewhere of the development of resistance to DDT and related insecticides in these insects [*cf.* **41** 86, 441; **43** 235], the effectiveness of DDT against them was re-assessed in Ontario and Quebec in 1953 and 1954. The following is partly based on the authors' summary of the work. Late cabbages in experimental plots were treated on 20th July and 2nd, 15th and 30th August with insecticidal sprays or dusts, the effectiveness of which was assessed as feeding injury to the foliage shortly before harvest, 2–4 weeks later. Sprays prepared from a 20 per cent. endrin emulsion concentrate or a 50 per cent. wettable DDT powder and a dust containing 3 per cent. DDT applied at rates of 0·25, 1 and 1 lb. toxicant per acre, respectively, all gave excellent control and were significantly superior to a dust of 4 per cent. malathion at 1·5 lb. toxicant per acre, which gave good but not outstanding control in both years, an emulsion spray of dieldrin at 0·25 lb., which was tested in one year only, a spray of wettable malathion at 1·5 lb. toxicant, which gave good control in Quebec in 1953, but only fair protection in both Provinces in 1954, and an emulsion spray of isodrin at 0·25 lb., which gave good protection in both Provinces in 1953 but was less satisfactory in Quebec in 1954. It was evident that DDT had maintained its effectiveness and that endrin should almost equal it.

Davey (K. G.). **Importance of the Sweetclover Weevil in Spread of Sweet Clover Root Rot in southwestern Ontario.**—*Canad. J. agric. Sci.* **35** no. 6 pp. 606–608, 8 refs. Ottawa, 1955.

The following is partly based on the author's abstract. *Phytophthora cactorum*, the fungus causing root rot of sweet clover [*Melilotus*], was readily isolated from the surface of larvae of *Sitona cylindricollis* Fhs. taken in the field in Ontario. It was also obtained from one of 12 pupae, but not from newly emerged adults. Lesions at the edges of larval feeding scars on the roots readily yielded isolates of the fungus. In laboratory experiments, two of 17 uninfected first-instar larvae placed on artificially cultured sweetclover roots that were inoculated with the fungus from a water culture transmitted the disease to healthy plants to which they were subsequently transferred. Third-instar larvae were numerous in May, and since disease symptoms become prominent in late April, it is possible that the larvae may be of importance in spreading the disease, either by acting as vectors or by providing points of entry for the fungus.

Green (H. L.) & Lane (W. R.). **Particulate Clouds: Dusts, Smokes and Mists. Their Physics and Physical Chemistry and Industrial and Environmental Aspects.**—10 × 6¼ ins., xix + 425 [+1] pp., 8 pls., 107 figs., many refs. London, E. & F. N. Spon, Ltd., 1957. Price £3 10*s*.

Particulate clouds include any type of suspension of particles in a gaseous medium, regardless of the nature of the suspended material, but excluding particles so large that they settle rapidly; the chief forms are dusts, smokes and mists. In the first part of this book, the authors review basic information on the physics and physical chemistry of such systems, and in the second, their industrial and environmental aspects. Their use in the application of insecticides is the subject of the final section (pp. 404–410), which includes brief discussions of the influence of droplet size on the effectiveness of sprays and aerosols, the main types of aerosol generators, the generation of insecticidal smokes, and the application of sprays and mists.

DE ONG (E. R.). **Chemistry and Uses of Pesticides.**—2nd edn., 9¼ × 6 ins., vii + 334 pp., 18 figs., many refs. New York, N.Y., Reinhold Publ. Corp.; London, Chapman & Hall, Ltd., 1956. Price £3 10*s*.

As indicated by the change in title, the scope of this second edition of a handbook already noticed [*R.A.E.*, A **37** 142; **39** 5] has been extended to include, not only insecticides and fungicides, but also repellents, seed protectants, herbicides and rodenticides. The arrangement of the matter is as before, but much of it, and notably the chapter on synthetic organic compounds, has been rewritten to include new information, and the section on legal requirements has been replaced by a list of the tolerances for pesticide residues in or on fresh fruits or vegetables in force in the United States in 1955.

RUPPEL (R. F.), CARMONA B. (C.), FIGUEROA P. (A.) & DELGADO M. (N.). **El control del cogollero, *Laphygma frugiperda* (Smith) en maíz en Colombia; con anotaciones sobre otras especies.** [The Control of *L. frugiperda* on Maize in Colombia, with Notes on other Species.]—*Agric. trop.* **12** no. 8 pp. 499–524, 5 figs. Bogotá, 1956.

RUPPEL (R. F.), BENAVIDES G. (M.) & SALDARRIAGA (A.). **Chemical Control of the Fall Armyworm, *Laphygma frugiperda* (S.), in Maize in Colombia.**—*FAO Plant Prot. Bull.* **5** no. 5 pp. 69–74, 2 figs., 1 ref. Rome, 1957.

Maize in Colombia is attacked severely by *Laphygma frugiperda* (J. E. Smith), *Agrotis ypsilon* (Hfn.) and *Dargida grammivora* Wlk., and to a less extent by *Prodenia ornithogalli* Gn., *Mocis repanda* (F.) and *Heliothis zea* (Boddie). In the first paper, the authors give notes on the bionomics of these species, with descriptions of the larvae, and the results of experiments with various insecticides in 1952–54 for the control of *L. frugiperda* feeding in the whorls of the plants. Materials that gave high mortality of the larvae and retained their effectiveness satisfactorily were toxaphene at 1·8 lb. per acre in dusts, sprays or granules, chlordane at 1·8 lb. in dusts, aldrin at 0·36 lb. in a dust and 0·45 lb. in a spray and endrin and isodrin at 0·45 lb. in sprays. A bait of 5 per cent. toxaphene in wheat bran placed in the whorls by hand at the rate of about 16·2 lb. per acre also gave very good mortality. In general, sprays and baits were more satisfactory than dusts, and the best results were obtained when treatments were applied while the plants were still small.

In the second paper, details are given of two further tests carried out in 1956. Three applications were made, the first at the time of full germination, and the others when the plants were 8–12 and 20–24 ins. high, respectively. Sprays were applied at about 36 gals. per acre. In the first test, emulsion sprays providing 1·8 lb. toxaphene, 0·45 lb. aldrin or 0·225 lb. parathion per acre and a wettable-powder spray of isodrin at 0·45 lb. per acre gave fair reductions in numbers of larvae at the time of the second application, whereas an emulsion spray of 0·45 lb. heptachlor per acre did not, and all treatments resulted in about the same yields; there was no yield from untreated plants. The same treatments were compared in the second test, together with endrin at 0·225 lb. per acre in an emulsion spray and a 5 per cent. toxaphene bait, applied to the whorls at about 22·5 lb. per acre. All treatments resulted in very great reductions in numbers of larvae at the time of the second application and in yields that did not differ significantly from one another but averaged 29 per cent. greater than the yield of untreated plants.

Shepherd (D. R.). **Khapra Beetle Eradication.**—*FAO Plant Prot. Bull.* **5** no. 5 pp. 75–77, 2 figs. Rome, 1957.

Surveys in 1955–56 in connection with the campaign for the eradication of *Trogoderma granarium* Everts from the United States, where it has recently become a potentially important pest of stored products [*cf. R.A.E.*, A **44** 445, etc.], showed that the Dermestid was present on 133 premises in Arizona, 279 in California and five in New Mexico. The survey was extended to the north of Mexico in 1956, and 38 infested premises were found in the States of Sonora and Baja California. The eradication treatment adopted is fumigation of individual buildings with methyl bromide at 5 lb. per 1,000 cu. ft., and it was applied to 258 premises in California, 98 in Arizona, all those in New Mexico and 21 in Mexico. As the beetle readily spreads to the exterior of buildings, these must be completely wrapped in tarpaulin for fumigation, and to ensure complete mortality of all stages, the concentration must be maintained at 2 lb. per 1,000 cu. ft. for any continuous period of 24 hours during the 48 hours for which the buildings are kept wrapped. The largest property fumigated contained nearly 5 million cu. ft., 9½ acres of tarpaulin were required to cover it, and 16 tons of methyl bromide were released; the operation was fully effective.

Shepherd (D. R.). **Eradication of Mediterranean Fruit Fly in Florida.**—*FAO Plant Prot. Bull.* **5** no. 7 pp. 101–103. Rome, 1957.

The campaign for the eradication of *Ceratitis capitata* (Wied.) from Florida, where an outbreak occurred in 1956 [*cf. R.A.E.*, A **45** 156, etc.], included surveys to detect centres of infestation and the application of bait-sprays for control. The surveys were carried out visually and by means of newly designed plastic dry traps and a new and powerful angelica-seed oil lure, and liquid traps baited with ammonium chloride. Dimethyl 2,2-dichlorovinyl phosphate was placed in the trap to kill the fruit-flies, together with a little chlordane to repel ants. Infestation was eventually found over an area of 760,000 acres in 28 counties [*cf. loc. cit.*]. The bait-spray used for control contained protein hydrolysate as an attractant and malathion as a toxicant, in water. It was extensively applied by aeroplane, and the use of the attractant made coverage of all areas unnecessary, since the adults were attracted to it from untreated areas. Spraying was begun in early May, and the area still requiring treatment had been reduced to 60,000 acres by the end of 1956. This good progress allowed 14 previously infested counties to be removed from quarantine, and the fly had apparently been almost eliminated from the State by the time of writing.

Rolston (L. H.). **The Southwestern Corn Borer in Arkansas.**—*Bull. Ark. agric. Exp. Sta.* no. 553, 40 pp., 6 figs., 14 refs. Fayetteville, Ark., 1955.

Zeadiatraea (*Diatraea*) *grandiosella* (Dyar) resumed its easterly advance across Oklahoma in 1941 and was observed in western Arkansas in 1950. By 1954, 22 counties in that State were infested. All stages of the moth are briefly described, details are given of the types of injury that it causes to maize, and observations on its bionomics made in 1952–54 are recorded. There were two or three generations a year, and occasional larvae of a fourth did not develop far enough to overwinter. Overwintering and subsequent pupation occurred in the stubble, below soil level, the pupal stage lasting 11–20 days and averaging 14·8 days. Adults of this generation were present in late May and early June. The females oviposited

mostly on large succulent plants, laying an average of about 200 eggs each; a maximum of over 600 was obtained from one female. The larvae hatched in 4–7 days and passed through five or more instars in 3–4 weeks, feeding predominantly in the whorl in the first three instars and then boring in the stalks or ears. Larvae of the summer generations pupated in the stalk above ground, the pupal stage lasting 8–13 days. Various other graminaceous plants were attacked in the laboratory, but none of them was extensively infested in the field. Sorghum appeared to be the most favourable.

The only parasite observed was *Trichogramma minutum* Ril., which usually attacked less than 20 per cent. of the eggs but parasitised 75 per cent. of the third generation in 1952. The intensity of the damage can be reduced by bringing the stubble to the surface in autumn, to expose the overwintering larvae to low temperatures, and by burying it in spring, to prevent the emergence of the adults. Losses can also be reduced by early planting and harvesting.

Harvey (T. L.) & Hackerott (H. L.). **Apparent Resistance to the Spotted Alfalfa Aphid selected from Seedlings of susceptible Alfalfa Varieties.** —*J. econ. Ent.* **49** no. 3 pp. 289–291, 8 refs. Menasha, Wis., 1956.

Myzocallis (*Therioaphis*) *maculata* (Buckt.) was found in Kansas in August 1954 and had been collected throughout the State by October 1955 [*cf. R.A.E.*, A **45** 11], and the desirability of developing a variety of lucerne resistant to it was evident. Tests of the resistant variety Lahontan and of various susceptible varieties, in which week-old seedlings were heavily infested with Aphids and the survivors transplanted after a month, showed that the elimination of susceptible plants in the seedling stage is a practical and rapid method of selecting resistant ones. A small proportion of plants of the susceptible varieties seemed to be resistant, so that resistance may occur in many other lucerne varieties. Evaluation of the resistance of the selected plants by comparison of plant reactions and Aphid populations after infestation with 50–100 individuals, or by caging Aphids on leaves and observing their numbers daily for five days, showed that variations occurred, but some of the plants appeared to be as resistant as Lahontan.

Zein-Eldin (E. A.). **Studies on the Legume Mite,** *Petrobia apicalis*.— *J. econ. Ent.* **49** no. 3 pp. 291–296, 6 figs., 12 refs. Menasha, Wis., 1956.

Petrobia apicalis (Banks), which probably occurs throughout the Gulf States and as far north as Missouri, has recently become a serious pest of clover and other leguminous plants in Louisiana [*cf. R.A.E.*, A **45** 151]. All stages of this Tetranychid are described, including the diapause (summer) and winter eggs, and an account is given of laboratory investigations on its life-history. The diapause eggs gave rise to about equal numbers of males and females, indicating that they are laid by fertilised females, since unfertilised females give rise to males only. Development of the winter eggs and the larval, protonymphal and deutonymphal stages (including the resting periods that occupy about the second half of each of these three) lasted for averages of 14, 7·7, 4 and 3·4 days, respectively at 58–60°F. and 3·8, 1·5, 1·2 and 1 at 78–86°F., and the adult males lived for averages of 36 and 15 days at the two temperature ranges. Females that deposited winter eggs had pre-oviposition, oviposition and post-oviposition periods of 8, 33 and 12 days at the lower temperatures and 0·7, 11 and 4 at the higher, and laid about 197 and 164 eggs each, respectively.

Females that deposited diapause eggs had average pre-oviposition, oviposition and post-oviposition periods of 10, 23 and 15 days at 58–60°F. and 1, 12 and 4·5 days at 78–86°F. and laid about 77 and 72 eggs. Diapause eggs required storage at a high temperature (80°F.) and a low relative humidity (20–40 per cent.) for 2–3 months after laying before the diapause could be eliminated by exposure to low temperature and high humidity. Eggs collected in late July and assumed to have been laid in April were kept at 58–60 or 78–80°F. Those kept at 58–60°F. hatched only at relative humidities of 80 per cent. or more, and those at 78–80°F. did not hatch at any of the humidities tested (20–100 per cent.). From these investigations and observations in the field, it is concluded that, once the first heavy rain falls in early autumn, hatching of the diapause eggs can be expected about a month after the average temperature falls to about 65°F. or lower, and control measures can then be taken before appreciable damage is caused to the crops. Treatment of the diapause eggs with xylene did not terminate the diapause and appeared to injure the eggs. Females from diapause eggs that hatched in September, October or early November and females of the next generation derived from them laid only winter eggs, regardless of temperature, daily photoperiod and availability of food, but 60 and 100 per cent. of those of the two subsequent generations deposited diapause eggs, also regardless of the three conditions. Under all conditions, females from diapause eggs that hatched in late November and early December and females of the next generation all deposited winter eggs, whereas 90 per cent. of those of the third generation laid diapause eggs, and about 25 per cent. of the females that hatched from diapause eggs in late January produced diapause eggs. It appears, therefore, that the older the diapause eggs at hatching, the smaller the number of active generations derived from them and the sooner diapause is initiated in their progeny. The deposition of diapause eggs appears attributable to inherent physiological changes in the parent female and to depend, at least partly, on a cumulative factor.

Hord (H. H. V.) & Flippin (R. S.). **Studies of Banana Weevils in Honduras.**—*J. econ. Ent.* **49** no. 3 pp. 296–300, 5 refs. Menasha, Wis., 1956.

In Honduras, a disease known as head rot weakens the rhizomes of banana so much that they break near ground level when the crown becomes too badly decayed to support the weight of the foliage and fruit. The decayed area is invariably tunnelled by weevils, and larvae and adults from diseased tissue and their eggs were found to be heavily contaminated by bacteria. *Cosmopolites sordidus* (Germ.) and *Metamasius sericeus* (Ol.) were collected from traps in banana plantations, but no transmission of head rot was obtained when adults of either species from diseased rhizomes were caged on healthy pseudostems or adults of *C. sordidus* on the freshly cut surfaces of rhizomes, when adults that had been caged on diseased tissue were allowed to oviposit on healthy rhizome buds, giving rise to larvae within 30 days, or when banana rhizomes and potato tubers were inoculated with an extract of the pulverised bodies of weevils that had been caged on infected tissue. Trap catches showed that *Cosmopolites* was attracted only to healthy rhizomes and the sound parts of decayed ones, whereas *Metamasius* somewhat preferred decayed to healthy tissue.

Treatment once a month with 0·15 per cent. chlordane, applied at the base of the plants through the bordeaux-spray system, at the rate of about 80 U.S. gals. per acre, reduced the number of weevils taken in 100 traps between 30th May and 12th June from 1,630 for an unsprayed area to 178.

and was more effective against *Cosmopolites* than against *Metamasius*. It had no effect on the incidence of head rot. Pairs of traps, one cut from rhizome and the other from pseudostem, were set out at the bases of the plants, and the catches showed that *C. sordidus* had a highly significant preference for rhizome over pseudostem and for the variety Gros Michel over Bout Rond; *Metamasius* showed no preferences. Freshly cut traps were the most attractive, and shaving off the dried surface of old traps every two days is recommended.

In a new plantation in which care had been taken to plant uninfested material, head rot was found in rhizomes showing no signs of attack by *Cosmopolites*, but, owing to the rapid propagation of the weevil, 95–100 per cent. of all the plants were infested a year later. Paring the lower half of the piece of rhizome to be planted, to destroy eggs without destroying buds that are likely to develop, and spraying the pieces with 0·1 per cent. chlordane to prevent further oviposition are suggested for preventing injury by the weevil in new plantations.

Merrell (D. J.) & Underhill (J. C.). **Selection for DDT Resistance in inbred, laboratory and wild Stocks of** *Drosophila melanogaster*.—*J. econ. Ent.* **49** no. 3 pp. 300–306, 29 refs. Menasha, Wis., 1956.

The following is based on the authors' summary. The development of resistance to DDT was studied in populations of *Drosophila melanogaster* Mg. derived from inbred, laboratory and wild stocks. Almost all the wild stocks and one of the laboratory stocks developed resistance, but the remaining six laboratory stocks and the two inbred ones did not, indicating that the ability of a population to become resistant is related to the amount of genetic variability in the original population. Hybrid populations obtained by crossing inbred or laboratory stocks did not become more resistant, which indicates either that the crosses produced little increase in variability and hence nothing new for selection to act upon, or that the variability was such that the new combinations of genes conferred no greater resistance than the old. Since the adults used to form the hybrid populations were of diverse origin and hence unlikely to be genetically identical, the second explanation seems more probable. The development of resistance was directly related to the intensity of the selection pressure, the higher concentrations of DDT being more effective in producing increased resistance. Resistance usually increased most rapidly during the first few months of selection. The stocks tended to have different levels of resistance, for some of the controls differed from each other, and the resistant stocks also differed from each other as well as from their controls. The level of resistance in the populations did not remain static, and three populations that had become more resistant later declined in resistance, despite continued exposure to DDT [*cf. R.A.E.*, A **42** 319].

The implications of the results are discussed in relation to the genetic mechanisms controlling resistance, the question of reversion to susceptibility on termination of exposure to DDT, and the amount of morphological and physiological change to be expected in association with resistance.

Warren (L. O.). **Behavior of Angoumois Grain Moth on several Strains of Corn at two Moisture Levels.**—*J. econ. Ent.* **49** no. 3 pp. 316–319, 10 refs. Menasha, Wis., 1956.

The following is substantially the author's summary. *Sitotroga cerealella* (Ol.) showed variable responses when reared on maize derived from 29 single-cross hybrids at moisture contents of 14 and 17 per cent. Differences in

average weight were significant at the 1 per cent. level between females reared on grain at the two moisture contents and at the 5 per cent. level between those reared on different hybrids with the same moisture content. Increasing the moisture content of the grain from 14 to 17 per cent. reduced the average period to initial emergence from all samples by an average of three days, though no significant correlation was detected between the durations of the immature stages on the same hybrid at the two moisture contents. A significant correlation at the 5 per cent. level was found between the duration of the immature stages and the weight of the adults reared on the different hybrids at 14 per cent. moisture, but not at 17 per cent. A strong positive relation was found between the length of the developmental period and the weight of the adult when the moisture content and maize strain remained constant. The smallest female weighed 0·7 mg., and the heaviest 11·2 mg. There was no significant correlation between oviposition and the weight of the adults reared on the hybrid grains at either moisture content, and there were no significant differences in larval survival in the grain of different hybrids at either moisture content or in the average weights of males reared at the two moisture contents or on different hybrids at the same moisture content.

Tanada (Y.). **Microbial Control of some Lepidopterous Pests of Crucifers.** —*J. econ. Ent.* **49** no. 3 pp. 320–329, 4 graphs, 12 refs. Menasha, Wis., 1956.

The following is based on the author's summary. *Pieris rapae* (L.), *Hellula undalis* (F.), *Plutella maculipennis* (Curt.) and *Trichoplusia ni* (Hb.) are important pests of cruciferous crops in Hawaii. In field tests in 1953–54, the first was effectively controlled by sprays of a granulosis virus, *Bergoldia virulenta*, recently described by the author from this host, and a bacterium, *Bacillus thuringiensis*. The virus was effective as a suspension in 1 U.S. gal. water of the body contents of two macerated fifth-instar larvae that had died of the disease, and the bacterium at 0·25 gm. dried spores per U.S. gal. (about 1 oz. per 100 U.S. gals.). The bacterium is the more promising as it kills the larvae in 2–4 days, as compared with 4–8 days for the virus. The larva of *P. maculipennis* appeared to be slightly more resistant to *B. thuringiensis*, a spray of 0·5 gm. spores per U.S. gal. being required for control, and both *H. undalis* and *T. ni* required about 1–2 gm. spores per U.S. gal. Indications were obtained that if infestation by the last two species is high, the bacterium may have to be applied at much higher concentrations or may be economically ineffective because of the presence of a few resistant individuals.

Triton B-1956 had no apparent adverse effect on the virulence of either pathogen when added to the sprays as a wetting agent at a concentration of 1:800, and sprays containing it appeared to be more effective than those prepared with wheat flour. The bacterium is known to be non-pathogenic for mammals, and the virus was harmless to rabbits that ingested it. Neither injured the sprayed plants, and it is concluded that they offer promise for the control of Lepidoptera on leafy vegetables, especially where the use of insecticides would result in the presence of poisonous residues. They showed no marked effects on insect parasites and predators.

Srivastava (B. K.) & Bryson (H. R.). **Insecticidal Seed Treatment for Control of the Thief Ant.**—*J. econ. Ent.* **49** no. 3 pp. 329–333, 1 fig., 9 refs. Menasha, Wis., 1956.

The following is based on the authors' introduction and summary.

Solenopsis molesta (Say) causes serious injury in south-central Kansas by destroying sown seeds of sorghum when weather and soil conditions are unfavourable for rapid germination [*cf. R.A.E.*, A **4** 184]. Injury is most severe in early spring and summer, when the temperature and soil moisture content are low, and as the ants construct their galleries and nests in the soil, they cannot be controlled by measures recommended against mound-building species.

In investigations on the effect of seed treatments, the materials tested were lindane [almost pure γ BHC], aldrin and heptachlor in wettable powders, Panogen PA-2 (a solution containing 0·4 per cent. methylmercuric dicyandiamide and 25·6 per cent. aldrin), Panogen PL-1 (a solution containing 0·5 per cent. methylmercuric dicyandiamide and 36·8 per cent. lindane), and Seed Guard (a wettable powder containing 16·5 per cent. lindane, 50 per cent. N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide [also known as N-trichloromethylthio tetrahydrophthalimide (captan)] and methyl cellulose). Sorghum seed of three varieties was treated with 2·5–5·5 oz. 75 per cent. aldrin, 3–5 oz. 25 per cent. lindane, 4–6 oz. 50 per cent. heptachlor, 6–8 fl. oz. Panogen PA-2, 2–3·5 fl. oz. Panogen PL-1 or 2·7 oz. Seed Guard per 100 lb. seed in January 1954, and the treated seeds were kept in sacks in a dry attic to simulate farm storage. When seeds, removed from each treated sample immediately or after storage for 1·5, 4 or 9 months, were set to germinate in a standard seed germinator, it was found that aldrin and Panogen PA-2 did not affect germination and growth, whereas lindane and Panogen PL-1 reduced them and Seed Guard stimulated them; heptachlor at the highest rate reduced the germination of milo sorghum. Similar results were obtained with seeds sown in loam soil immediately after treatment. Injury did not increase in intensity during the nine months of storage.

The heptachlor, aldrin and lindane wettable powders and Seed Guard were applied to sorghum seeds at rates of 2–32 oz. per 100 lb. to determine the amounts that would adhere to the seed coats. At all rates, Seed Guard adhered more evenly and was retained in larger amounts than the other materials, the differences being greater at dosages of 8 oz. or more; the amount of Seed Guard retained increased in proportion to the amount applied up to 16 oz., but declined slightly at 32 oz., whereas the amounts of other materials retained generally declined from 8 to 16 oz. and showed only a slight increase at 32 oz. Aldrin, which was the most finely ground, coated the seed more uniformly than lindane, and heptachlor which was coarse, less so.

In laboratory tests, treatment of milo sorghum seed with 4·5, 4, 2·7 and 5 oz. of the aldrin, lindane, Seed Guard and heptachlor powders, respectively, 7 fl. oz. Panogen PA-2 and 2·8 fl. oz. Panogen PL-1 per 100 lb. seed protected it from damage by ants; over 50 per cent. of the untreated seed was injured.

Richardson (B. H.) & Wene (G. P.). **Control of Onion Thrips and its Tolerance to certain Chlorinated Hydrocarbons.**—*J. econ. Ent.* **49** no. 3 pp. 333–335, 11 refs. Menasha, Wis., 1956.

Investigations on the insecticides recommended for control of *Thrips tabaci* Lind. on onion in Texas [*cf. R.A.E.*, A **44** 168, etc.] were continued in 1954–55. In the Winter Garden area, sprays of 0·5 lb. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)], Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] and DDT, the last

with 0·3 lb. BHC, in 23 U.S. gals. water per acre applied by ground machine, gave 71–77 per cent. reduction in numbers of thrips in one day, and 61–75 per cent. after five days, ethyl-DDD having the least residual effect, and heptachlor, dieldrin, aldrin, endrin and toxaphene were ineffective. In another test, 0·25 lb. parathion or methyl-parathion, 0·63 lb. malathion and 0·19 lb. dieldrin, the last with 0·25 lb. parathion, gave over 70 per cent. reduction in one day, but only the last gave over 70 per cent. after six days, and Pyrazoxon [diethyl 3-methyl-5-pyrazolyl phosphate] and Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] were ineffective. When applied in 4 U.S. gals. water per acre by aeroplane, 0·38 lb. parathion gave 71·8 per cent. reduction in one day, and this, 0·63 lb. malathion and 0·19 dieldrin with 0·31 lb. malathion gave about 75–90 per cent. after 4–6 days; the first two were ineffective after nine days, but malathion alone still gave 86 per cent. reduction after 12.

In the Lower Rio Grande Valley, 2·5 per cent. heptachlor in a dust applied at 20 lb. per acre gave only 67 per cent. reduction in one day, but dusts of 5 per cent. heptachlor, 4 per cent. Diazinon and 1 per cent. parathion, the last alone or with 2·5 or 5 per cent. heptachlor, gave 86–99 per cent. Sprays of 0·5 lb. malathion, alone or with 0·19 or 0·38 lb. dieldrin or 0·2 or 0·5 lb. heptachlor, in 5 U.S. gals. water per acre, applied by ground machine, gave at least 78 per cent. reduction in one day, and all but the first gave 62–70 per cent. after seven; dieldrin, heptachlor and toxaphene alone were ineffective. Similar sprays of 1 lb. malathion and of 0·5 lb. malathion with 1 lb. ethyl-DDD gave 80–92 per cent. reduction after 1–7 days, whereas 0·5 lb. Diazinon or Hercules AC 528 (2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)) gave only 68 and 44 per cent. reduction in one day, but 83 per cent. after seven.

It is concluded that thrips tolerance to the chlorinated hydrocarbons [*cf.* **44** 169] has extended to the Lower Rio Grande Valley, but that the phosphorus compounds show no loss of effectiveness.

Davis (J. M.), Waters (W. E.), Isler (D. A.), Martineau (R.) & Marsh (J. W.). **Experimental Airplane Spraying for Spruce Budworm Control.**—*J. econ. Ent.* **49** no. 3 pp. 338–341, 2 graphs. Menasha, Wis., 1956.

Selection of the proper atomisation and time of application is of paramount importance in forest spraying for the control of insects. An account is given of tests carried out in 1951 on plots of balsam fir [*Abies balsamea*] heavily infested by the spruce budworm [*Choristoneura fumiferana* (Clem.)] in Quebec, in which aeroplane applications of fine, medium and coarse atomised sprays (80, 150 and 300 microns mass median droplet diameter, respectively) of 0·25, 0·5 and 1 lb. DDT in 1 gal. oil per acre, made either when most of the larvae were in the third instar or when most were in the fourth and fifth instars, were compared to find the most effective combination. The aeroplanes flew at about 80 miles per hour at a height of some 50 ft. above the canopy, and the wind speed did not exceed 2·4 miles per hour.

DDT deposit and insect mortality were measured on sample trees, and it was found that the fine sprays resulted in significantly lower deposits than the coarse and medium ones, the last proving most consistently effective, and that the 1 lb. dosage resulted in significantly higher deposits than the other two and was the lowest that would give very high kills. Control was best when spraying was begun during the 4th–5th larval instars, when an average deposit of 0·11 lb. DDT per acre from the medium spray

gave 95 per cent. mortality; deposits of 0·22 and 0·26 lb. per acre were necessary for similar control from coarse and fine sprays, respectively.

Guthrie (F. E.) & Rabb (R. L.). **Broadcast Treatments with Insecticides and Soil Fumigation for Tobacco Wireworm Control.**—*J. econ. Ent.* **49** no. 3 pp. 344–347, 8 refs. Menasha, Wis., 1956.

Tests were made in North Carolina in 1955 to compare various insecticidal treatments for the control of wireworms attacking tobacco. *Conoderus vespertinus* (F.) was the only species present in the test areas. Granular formulations of 2 per cent. aldrin or dieldrin or 5 per cent. chlordane and dusts of 2·5 per cent. heptachlor or 2 per cent. endrin were broadcast in mid-March at rates of approximately 4, 2, 6, 4 and 2 lb. actual compound per acre on soil that had been broken and harrowed, and disked in within 72 hours, and the tobacco was set in mid-April with mechanical setters and examined a fortnight later. None of the treatments affected plant growth. Dieldrin, heptachlor and aldrin gave excellent protection against a heavy wireworm infestation, and chlordane, which was not tested against a heavy infestation, was effective against a moderate one. Endrin gave significant control, but was significantly inferior to the other treatments.

The effect on wireworms of soil fumigants applied against nematodes was investigated in experimental plots in 1953–55; most of the wireworms found were *C. vespertinus*. Applications of ethylene dibromide and D-D mixture (dichloropropane and dichloropropene) at a depth of six inches in the middle of each furrow in March caused some reduction in infestation, with no difference between treatments, but did not give commercial control. A few broadcast applications in twelve-inch bands to a depth of six inches in March or November appeared to be more effective, with no differences due to time of treatment. A survey in 1954 and 1955 of tobacco fields in which the fumigants were applied in rows or broadcast confirmed these results.

Lienk (S. E.), Chapman (P. J.) & Curtis jr. (O. F.). **Responses of Apple Trees to Mite Infestations: II.**—*J. econ. Ent.* **49** no. 3 pp. 350–353, 1 graph, 2 refs. Menasha, Wis., 1956.

In further investigations on the effect of mites on the productivity of apple trees in New York [*cf. R.A.E.*, A **41** 140], carried out in 1952 in the same two orchards as in 1951, acaricides were again applied to half the trees and insecticides and fungicides to all. However, a mixture of Tag [phenyl mercuric acetate] and glyodin [2-heptadecyl glyoxalidine acetate], applied as a fungicide during the flowering period, virtually eliminated *Metatetranychus ulmi* (Koch) (*Paratetranychus pilosus* (C. & F.)) and prevented infestation by *Tetranychus telarius* (L.) (*bimaculatus* Harvey) until late in the season in one orchard, so that almost all the effects noted in it in 1952 could be attributed to mite activity in 1951. This apparently had a pronounced effect on fruit-bud formation and resulted in reductions of 75 and 34 per cent. in amount of bloom and 64·8 and 35·8 per cent. yield of fruit on the Cortland and Red Delicious varieties, respectively, in 1952. In the other orchard, a moderate population of *M. ulmi* reached its peak by about 5th–15th July and caused crop reductions that were significant for one variety but not for another. No appreciable difference in growth, based on trunk-girth measurements, was found between infested and uninfested trees in either orchard, probably because of the very low mite population during most of the growing season in the first orchard and light infestation and poor growing conditions in the second.

Forbes (A. R.) & King (K. M.). **Practical Application of Chemical Controls of Root Maggots in Rutabagas.**—*J. econ. Ent.* **49** no. 3 pp. 354–356, 3 refs. Menasha, Wis., 1956.

Tests were made in British Columbia in 1954 mainly to investigate the effectiveness on a field scale of treatments that had proved effective against *Hylemyia* spp. on swedes when applied by hand [*cf. R.A.E.*, A **44** 241]. *H. brassicae* (Bch.) was the chief species present, and the attack was severe. Band and spray treatments with heptachlor, made by means of a fertiliser cart and a two-row power sprayer, respectively, were compared with the same treatments by hand [*cf.* **43** 240], and band and spray applications of aldrin by hand and furrow treatment with heptachlor and aldrin by hand were included. The rows were 3 ft. apart, and heptachlor was applied at totals of 5, 3 and 2·5 lb. per acre and aldrin at 5, 5 and 2·5 lb., respectively, for the three treatments. The reductions in damage averaged 80–90, 93–97 and 90–96 per cent. for the band, spray and furrow methods of application, respectively, with no significant differences between field-scale and hand treatment. All treatments greatly increased the yield of marketable swedes but had no effect on total yield. The practical effectiveness of field-scale control was confirmed by growers, who treated considerable areas with aldrin by the band or spray method, and it is concluded that the band method is suitable for treating up to five acres of swedes and the spray method where a row-crop sprayer is available and larger areas are to be treated. Furrow treatments, though effective, are not recommended because of the danger of phytotoxicity.

Reynolds (H. T.) & Deal (A. S.). **Control of the Southern Garden Leafhopper, a new Pest of Cotton in southern California.**—*J. econ. Ent.* **49** no. 3 pp. 356–358, 9 refs. Menasha, Wis., 1956.

Empoasca solana DeLong was first found injuring cotton in California in a field in the Imperial Valley in July 1952. It became more widespread in 1953, and surveys showed large populations of the Cicadellid in many fields of beet. Increase is apparently rapid on this crop, and, when it becomes unattractive, migration to cotton occurs. Heavy infestation seriously affects fruiting and discolours and thickens the cotton leaves, particularly at the edges, but occurs only during the early growing season, populations usually dropping below the economic level in late June or July.

Tests of insecticides for the control of *E. solana* were begun in July 1952, when approximately 1·3 lb. DDT per acre, in 21 U.S. gals. spray or with 13·5 lb. sulphur in 27 lb. dust, and 0·2 lb. parathion and 1·3 lb. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] in 21–22 U.S. gals. spray per acre proved very effective, and a spray of demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] and dusts of toxaphene and dieldrin progressively less so. Many growers obtained excellent control with DDT in 1952, but failures were reported in 1953. Further tests were therefore made in 1954 in which sprays were applied at about 6 U.S. gals. per acre by ground sprayer in June; 1·33 lb. ethyl-DDD per acre gave outstanding results, with residual control for at least 21 days, and 0·42 lb. parathion and 0·7 lb. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] gave very good immediate control, with some residual effect for a fortnight. Malathion, Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] and DDT gave only fair results, though the first had proved effective when applied commercially by aeroplane.

Four systemic insecticides were applied in 6 U.S. gals. water per acre

with a ground sprayer on 1st July 1954, and 6 oz. demeton and 12 oz. Am. Cyanamid 12008 and 12009 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate and O,O-diethyl S-n-propylthiomethyl phosphorodithioate, respectively] per acre gave very good control for a fortnight; 6 oz. of the last two were less effective, but not significantly so, and 6 oz. Pyrazoxon [diethyl 3-methyl-5-pyrazolyl phosphate], though significantly better than no treatment, was significantly inferior to the other materials by 16th July.

van den Bosch (R.), Reynolds (H. T.) & Dietrick (E. J.). **Toxicity of widely used Insecticides to beneficial Insects in California Cotton and Alfalfa Fields.**—*J. econ. Ent.* **49** no. 3 pp. 359–363, 3 refs. Menasha, Wis., 1956.

The following is based largely on the authors' summary. Predators give important control of injurious insects on cotton and lucerne in California, and insecticide programmes for use on these crops should be arranged so as to take advantage of this. Attempts were made in the summer of 1954 to evaluate the effect of the commoner insecticides on the most important insect predators, which comprised unidentified species of *Orius*, *Geocoris*, *Nabis*, *Chrysopa* and *Hippodamia* on both crops. The materials tested tended to fall into groups, parathion and combinations of toxaphene and DDT being highly toxic, toxaphene, endrin and DDT alone being moderately toxic, and demeton showing only limited toxicity to the predators. Considerable specificity was evident, particularly in the second group; endrin appeared to be practically harmless and DDT and toxaphene rather toxic to adults of *Hippodamia* when applied in dusts to cotton, whereas DDT was distinctly less toxic than toxaphene or endrin to *Geocoris*. *Chrysopa* larvae and *Orius* sp. were relatively tolerant of insecticides.

The results indicate that a DDT dust, applied at the rate of 1–1·5 lb. toxicant per acre, is the least harmful to beneficial insects of the materials widely used on both crops, whereas a dust mixture of toxaphene and DDT, which is being increasingly applied to cotton, is severely toxic and should be applied only where the effect on predators is not important.

Harries (F. H.). **Variation in Effectiveness of Derris Dusts against the Pea Aphid.**—*J. econ. Ent.* **49** no. 3 pp. 363–367, 14 refs. Menasha, Wis., 1956.

The following is substantially the author's summary. In laboratory tests in 1940–43 to investigate the reasons for variation in the effectiveness of derris dusts against *Macrosiphum pisum* (Harris) [*cf. R.A.E.*, A **32** 347], dusts containing 1 per cent. rotenone prepared from different samples of ground derris root were applied to infested pea plants in factorial experiments under differing conditions of temperature, relative humidity and free moisture on the foliage.

Temperature and relative humidity had little effect on the reduction in the time of survival of the adult Aphids, but fewer of their progeny survived at the higher temperatures and humidities; these are apparently not important factors in the effectiveness of the dusts. More important effects were noted when the plants were wet with rain or dew. Moisture increased the residual action of the dusts while the plants were still wet, but it was lost as soon as they dried, apparently owing to caking or hardening. Thus, the dusts would be expected to be effective in both dry and wet weather, but

not when the occurrence of moisture on the plants is followed by a period with no rain or dew.

Talc impregnated with derris extract was significantly more toxic than mixtures of derris and talc with the same rotenone content. The toxicity of the dusts was not affected by their derris content, but increased with greater fineness of grinding of the derris root, probably owing to more thorough breaking down of the plant structures. The kind of diluent and its particle size had a marked effect on toxicity.

McPherson (J. E.), Newsom (L. D.) & Roussel (J. S.). **Response of *Heliothis zea* (Boddie) and *H. virescens* (F.) to DDT and Endrin in Laboratory Toxicity Studies.**—*J. econ. Ent.* **49** no. 3 pp. 368–371, 1 graph, 10 refs. Menasha, Wis., 1956.

Heliothis zea (Boddie) and *H. virescens* (F.) are becoming increasingly important as pests of cotton in Louisiana, and have sometimes been inadequately controlled because of poor timing of insecticide applications. To determine the reason for the unsatisfactory results, laboratory tests were made of the comparative susceptibility to insecticides of each instar of the larvae of both species. The results showed that the first three instars of both were readily controlled by a 10 per cent. DDT dust applied at 5–10 lb. per acre, but many larvae in the fourth instar survived and very few in the fifth or sixth were killed even at rates of 15 lb. per acre. A dust containing 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur gave similar results in tests against *H. zea*. Topical applications of DDT and endrin in acetone showed that larvae of *H. zea* were more susceptible to both insecticides than were those of *H. virescens* [*cf. R.A.E.*, A **45** 275]. The latter were equally susceptible to DDT whether reared on soy-bean seedlings or hairy vetch [*Vicia*].

Kerr jr. (T. W.) & Stuckey (I. H.). **Insects attacking Red Clover in Rhode Island and their Control.**—*J. econ. Ent.* **49** no. 3 pp. 371–375. Menasha, Wis., 1956.

In Rhode Island, red clover can be harvested during the year of sowing and the next, but fails by the third year, and since it was thought that this might be due to attack by insects, those of importance in its production, their control by the use of insecticides and the resulting yields of hay were investigated during 1951–54. The insects were collected by sweeping, and information is given on the occurrence of 24 of the 37 species recorded, the most abundant of which were *Macrosiphum pisum* (Harris), *Lygus lineolaris* (P. de B.), *Melanoplus femur-rubrum* (Deg.), *Popillia japonica* Newm., *Macrosteles fascifrons* (Stål) and *Agallia constricta* Van D. The Aphid was controlled by dusting with 1·5 per cent. lindane [almost pure γ BHC] or spraying with 4 lb. 25 per cent. wettable malathion per 100 U.S. gals., and DDT in a 5 per cent. dust or a spray containing 1–2 lb. 50 per cent. wettable powder per 100 U.S. gals. reduced populations of Coleoptera and Cicadellids, whereas a 5 per cent. chlordane dust resulted in increases in Cicadellids. The yield was increased by dusting with γ BHC or DDT or spraying with malathion, but not by dusting with chlordane. On several occasions, the increased yields were obtained, not from the cutting to which the insecticide was applied, but from succeeding cuttings of the same or the following year. Insecticide residues at harvest were less than 0·25 and 1·2 parts per million of the green and dry weight, respectively, for malathion, but up to 17 p.p.m. of the dry weight for DDT. Most of the plants

were dead, as usual, by the third spring, and the commonest cause appeared to be root rot, caused by *Fusarium*.

Riehl (L. A.), Wedding (R. T.) & Rodriguez (J. L.). **Effect of Oil Spray Application Timing on Juice Quality, Yield, and Size of Valencia Oranges in a Southern California Orchard.**—*J. econ. Ent.* **49** no. 3 pp. 376–382, 3 graphs, 14 refs. Menasha, Wis., 1956.

Sprays of oil emulsion have several advantages for the control of Coccids and mites on *Citrus* in California, but have been reported to reduce the quality of the juice of oranges [*cf. R.A.E.*, A **30** 437]. Investigations were therefore carried out in an orchard of Valencia orange that had not received oil sprays for at least three years in southern California in 1951–54. In this area, the trees bloom in April and mature their fruits 14–18 months later, and as annual applications in summer may result in two treatments of each crop, the effect of one or two annual treatments at different times of year on the content of soluble solids in the juice, the number of fruits per tree and fruit size was determined by comparing the results of spraying with 1·75 per cent. light-medium oil in the middle of each month from March 1951 to September 1953 with those of fumigating with hydrogen cyanide in December and spraying, when necessary, with an acaricide containing no oil.

The results showed that the percentage of total soluble solids in the juice was reduced significantly by treatment with oil in November–June, but was not significantly affected by treatment in late summer. Analysis of samples taken in June and October 1953 showed that the content of soluble solids increased more between those dates in oranges receiving no oil than in those receiving two annual oil sprays. Significant reductions in the percentage of acid occurred in fruits treated with oil in winter, particularly when the spray was applied twice during the development of the fruit, but the ratio of solids to acid was not significantly altered. The percentage content of juice did not seem to be affected by time of application. The number of fruits per tree was not significantly affected by oil sprays applied in September–December, but it declined fairly steadily as treatment was delayed from October to June and the reduction became significant by January. The fruits were larger on oil-sprayed than on fumigated trees. The addition of 4 parts per million of 2,4-D (2,4-dichlorophenoxyacetic acid) as the isopropyl ester to oil sprays applied in July–September appeared to reduce the drop of mature fruits during the next crop season, but caused no appreciable increase in yield; it did not affect the percentage of total soluble solids or the number of fruits per tree.

It is concluded that reductions in juice quality or yield of Valencia oranges are less likely to occur from applications of oil spray in the late summer than at any other time of year.

Stearns (L. A.). **Meadow Spittlebug and Peach Gumosis.**—*J. econ. Ent.* **49** no. 3 pp. 382–385, 1 fig., 13 refs. Menasha, Wis., 1956.

The following is taken from the author's summary. Increases in Delaware in the last ten years of a distinctive type of injury to peach, in which gum exudes in droplets from minute punctures on the fruits, have apparently accompanied increased populations of *Philaenus leucophthalmus* (L.), and the time of observed injury has coincided with the maturing of this Cercopid and its migration from lucerne, clover and other plants on

which the nymphs develop. In 1955, it was shown by means of adhesive traps that the adults moved into peach orchards from the week of 17th–23rd May, were most numerous from 21st to 26th June and had practically disappeared by the end of July. Gum-exudation was first observed on 13th June and was rather common by 14th July, and as adults produced identical damage in cages, it is concluded that they are responsible for the injury.

McEwen (F. L.) & Hervey (G. E. R.). **An Evaluation of newer Insecticides for Control of DDT-resistant Cabbage Loopers.**—*J. econ. Ent.* **49** no. 3 pp. 385–387, 13 refs. Menasha, Wis., 1956.

Trichoplusia ni (Hb.), which had apparently become resistant to DDT in western New York in 1953 [*cf. R.A.E.*, A **43** 235], was scarce on cruciferous crops in 1954, but numerous in 1955, when DDT proved even less effective against it. In laboratory tests in which larvae were confined for 44 hours on leaves sprayed with several new insecticides, only 0·0625 per cent. Shell OS-2046 [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] and 0·03125 per cent. endrin caused high mortality; parathion and Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] were somewhat less effective, though there was little feeding on foliage sprayed with parathion, and DDT at 0·125 per cent. was relatively useless.

In field tests on cabbage, in which sprays were applied against the larvae at 26 U.S. gals. per acre in August or September, endrin at 0·5 lb. and isodrin and Shell OS-2046 at 1 lb. per acre gave about 90 per cent. reduction in population; 0·5 lb. parathion and 2 lb. toxaphene were unsatisfactory when applied separately but gave 75 per cent. reduction when mixed, DDT gave only about 45 and 55 per cent. reduction at 0·5 and 1 lb. per acre, respectively, and was not improved by the addition of parathion, and Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], Bayer 17147 and dieldrin did not give commercial control.

Hallock (H. C.) & Douglass (J. R.). **Studies of four Summer Hosts of the Beet Leafhopper.**—*J. econ. Ent.* **49** no. 3 pp. 388–391, 3 figs., 12 refs. Menasha, Wis., 1956.

The following is based on the authors' summary. *Halogeton glomeratus*, *Kochia scoparia*, *Salsola kali* var. *tenuifolia* and *Bassia hyssopifolia* serve as reservoirs of the curly-top virus and as summer food-plants of *Circulifer tenellus* (Baker) in the breeding areas of this Cicadellid in south-central Idaho, eastern Oregon, north-eastern Nevada and north-western Utah. Laboratory studies indicated that the first two are much more suitable than the others as virus reservoirs, and field studies that the last two are about equally suitable, and much more so than *Halogeton*, for reproduction of the insect.

Dobson (R. C.) & Watts (J. G.). **Adult Buprestid causes Crop Damage.**—*J. econ. Ent.* **49** no. 3 p. 391, 2 refs. Menasha, Wis., 1956.

Adults of *Psiloptera drummondi* (Lap. & Gory) have been observed injuring various plants in New Mexico and Texas in recent years. They girdle the terminals of cotton and the twigs of honey locust (*Gleditsia triacanthos*) and clip the green nuts from pecan and the fruiting stems from bear grass (*Nolina microcarpa*). In August 1954, an application of 30 lb.

5 per cent. DDT dust per acre from an aeroplane gave good control of the Buprestid in a cotton field in New Mexico in which 80–90 per cent. of the terminals had been clipped.

Jefferson (R. N.) & Morishita (F. S.). **Rohm & Haas FW-293 for Mite Control on Ornamentals.**—*J. econ. Ent.* **49** no. 3 pp. 392–393, 3 refs. Menasha, Wis., 1956.

Tetranychus telarius (L.), *Brevipalpus inornatus* (Banks) and *Steneotarsonemus pallidus* (Banks) are the most important of the mites that attack ornamental plants in southern California; the first is the commonest and attacks the widest range of plants, but the last is the most difficult to control.

In laboratory tests begun in April 1955, three weekly applications of emulsion sprays containing 1 U.S. quart 18·5 per cent. FW-293 [1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol] or 17·5 per cent. endrin, each with 4 oz. Triton X-100, per 100 U.S. gals., were made to ornamental plants heavily infested by *S. pallidus*. No living mites were found on treated plants examined just before the second application; six weeks after the first application, treated plants were recovering, with no evidence of additional mite damage, but after three months, a few plants treated with FW-293 were beginning to show fresh signs of mite injury; untreated plants remained heavily infested. Treatments begun in August had similar results; all treated plants had recovered and were making good growth by the end of September, but a few sprayed with FW-293 showed evidence of mite injury during November.

In greenhouse tests on a commercial scale, made in July–November, in which high-volume sprays were applied with power equipment, with the object of eradicating the mites, three applications of 1·5–2 pints 18·5 per cent. FW-293 per 100 gals. at intervals of about 1–2 weeks effectively eliminated populations of *S. pallidus* and *B. inornatus* on various plants, and single applications of 1 lb. 18·5 per cent. wettable FW-293 per 100 U.S. gals., with a colloidal spreader and deposit builder, eradicated a light infestation of *T. telarius* and *B. inornatus* on tropical and subtropical plants, and gave good control, but not eradication, of the first on roses; in one test, a single thorough application of 1 U.S. quart 18·5 per cent. emulsion with 4 oz. Triton X-100 per 100 U.S. gals. apparently eliminated *S. pallidus*. There was no significant spray injury to any of the plants used.

King (D. R.) & Morris (H. F.). **Biologies of the Peach Tree Borer and Lesser Peach Tree Borer in east Texas.**—*J. econ. Ent.* **49** no. 3 pp. 397–398, 2 figs., 4 refs. Menasha, Wis., 1956.

The satisfactory control of *Aegeria* (*Sanninoidea*) *exitiosa* Say on peach in eastern Texas given by trunk sprays applied during the period of adult emergence and oviposition [*cf. R.A.E.*, A **42** 98] was not repeated in the following year, owing to variations in the time of adult emergence, and life-history studies of this species and of *A.* (*Synanthedon*) *pictipes* G. & R. were therefore begun. Larval and pupal populations were sampled twice a week from January 1954 to January 1955, and adult emergence determined in 1955 by weekly counts of empty pupal cases round the bases of the trees. Measurement of head capsules indicated that *A. exitiosa* generally passes through six larval instars, though a few individuals may require only five. There was one generation in the year, and adult emergence occurred from late May to October, with a decline in early August and a peak in

September. *A. pictipes* passes through six larval instars, and may overwinter in any but the first. A large proportion of the larvae transform to adults in September and give rise to a partial second generation in the year; the remainder overwinter in the sixth instar. Adults from overwintered larvae emerge mainly in late April or early May.

Swift (J. E.) & Madsen (H. F.). **Thrips Damage to Apple.**—*J. econ. Ent.* **49** no. 3 pp. 398–399, 2 figs., 3 refs. Menasha, Wis., 1956.

Fruit pitting on the Golden and Red Delicious varieties of apple in the Anderson Valley of California was found to be due to oviposition by *Thrips madroni* Moult. Adults were present in the blossoms as early as the pink-bud stage, and eggs were laid in punctures in the young fruits from late bloom to petal fall. After this period, neither nymphs nor adults could be found on the trees. Other varieties of apple showed slight damage in the early stages of fruit development, but outgrew it before harvest.

In 1954, spray applications on 19th and 26th April, respectively, resulted in 1 and 4·6 per cent. pitted fruits at harvest, and in 1955, in plot tests in which sprays of 2 lb. 50 per cent. wettable DDT per 100 U.S. gals. were applied at the pre-bloom or petal-fall stages or two weeks later (4th April and 2nd and 16th May), only the first reduced the percentage of pitted fruits. Such injury as occurred on trees receiving this application may have been due to reinfestation from unsprayed trees during the flowering period, and it is possible that treatment of an entire orchard at the pre-bloom stage might give commercial control.

Tsao (C. H.) & Hodson (A. C.). **The Effect of different Host Species on the Oviposition and Survival of the Introduced Pine Sawfly.**—*J. econ. Ent.* **49** no. 3 pp. 400–401, 6 refs. Menasha, Wis., 1956.

Records in the eastern United States and Minnesota indicate that *Diprion similis* (Htg.) is likely to attack white pine (*Pinus strobus*) more heavily than two-needled species of pine. Tests in which adults were caged on *P. strobus*, Scots pine (*P. sylvestris*), red pine (*P. resinosa*), jack pine (*P. banksiana*) and mugho pine (*P. mugo*) showed that the females preferred *P. strobus* for oviposition and deposited most eggs on it. Examination of eggs in the field at the time of hatching showed that egg survival was rather lower on *P. strobus* than on the other species and highest on *P. mugo*, and laboratory rearing tests that larval survival was highest on *P. strobus* and lowest on *P. mugo*.

Randolph (N. M.). **Control of Insects affecting Vetch Seed Production.**—*J. econ. Ent.* **49** no. 3 pp. 403–404, 3 refs. Menasha, Wis., 1956.

Tests were made in Texas in 1955 to determine the effect of insecticides on insects attacking vetch [*Vicia*], of which the most important were *Macrosiphum pisum* (Harris), cutworms (mainly *Peridroma saucia* Hb. (*margaritosa* (Haw.)) and *Agrotis ypsilon* (Hfn.)) and armyworms (mainly *Pseudaletia unipuncta* (Haw.)). Each insecticide was applied once on 5th April in 6 U.S. gals. spray per acre, and a mixture of 2 lb. toxaphene and 1 lb. DDT per acre controlled the Aphid for three weeks and 0·25 lb. parathion for two; 0·5 lb. malathion was fairly effective for three weeks. Populations of the Aphid were higher in treated than in untreated plots after four weeks, apparently owing to destruction of beneficial insects by the

sprays, but decreased after five. The three sprays gave almost complete, fair and very poor control, respectively, of the cutworms and armyworms during the period necessary for seed production. The seed was harvested on 1st June, and the mixture, parathion and malathion, increased the yield from 152 to 424, 336 and 264 lb. per acre, respectively.

King (D. R.) & Rosberg (D. W.). **Control of *Tetranychus hicoriae* McG. on Pecans.**—*J. econ. Ent.* **49** no. 3 pp. 404–405, 1 ref. Menasha, Wis., 1956.

Damaging populations of *Eotetranychus* (*Tetranychus*) *hicoriae* (McG.) often develop on pecan in late summer and autumn after the application of insecticides and fungicides [*cf. R.A.E.*, A **42** 78], and cause defoliation before the nuts mature. In tests in Texas, in which insecticides effective against *Acrobasis caryae* Grote were applied on 6th May 1955 to determine their effect on the growth of populations of the mite, single applications of 1–2 lb. 50 per cent. wettable DDT or 25 per cent. wettable malathion, 5 or 3·5 lb. 40 per cent. wettable toxaphene or 1·25 U.S. pints 18·5 per cent. emulsifiable endrin per 100 U.S. gals. all increased mite populations, whereas 2 lb. 50 per cent. wettable DDT with 6 lb. sulphur per 100 U.S. gals. did not.

In tests in which fungicides were applied four times, treatment with 2 lb. zineb [zinc ethylene bis(dithiocarbamate)] per 100 U.S. gals. was found in 1953 to suppress the development of the mite, whereas captan [N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide], bordeaux mixture and a chlorinated organic mercury compound appeared to have little effect and phenylmercuritriethanolammonium lactate increased it considerably; in further tests, mite populations were four times as great on trees receiving bordeaux mixture as on those sprayed with zineb. In 1954 and 1955, three applications of zineb, alone or with DDT, kept mite populations below the level of those on untreated trees or trees sprayed once with DDT and sulphur, and in 1955, a single application reduced an established infestation, though less adequately than a sulphur spray.

Connin (R. V.). **Oversummering Volunteer Wheat in the Epidemiology of Wheat Streak-mosaic.**—*J. econ. Ent.* **49** no. 3 pp. 405–406, 8 refs. Menasha, Wis., 1956.

Observations in Kansas in 1953 showed that *Aceria tulipae* (Keifer) was abundant on wheat over much of the area in which streak mosaic was reported [*cf. R.A.E.*, A **45** 91, etc.], but was absent or not numerous elsewhere. After harvest, it was found in small numbers on *Agropyrum smithii* [*cf.* **44** 417] over most of the area and on *Elymus canadensis*, *Setaria viridis* and *Digitaria ischaemum* in isolated localities. Large areas of self-sown wheat were found in the north-central, western and central parts of the State and scattered patches in the north-east, and microscopic examination of the plants showed that the mite was most abundant on the early self-sown wheat; plants infected with the mosaic were prevalent in the north-central area and present in all. Examination of autumn-sown wheat in late September revealed the presence of mites in the areas in which they had been found on self-sown wheat during the summer, and periodical observations indicated that they were carried into it by the wind from self-sown wheat in the neighbourhood. Mites were absent or scarce in areas in which there had been no early self-sown wheat in summer, even though the fields were adjacent to infested *Agropyrum*, and it is concluded that this grass has

little influence on the spread of the mosaic, to which it is immune, whereas self-sown wheat that appears before or soon after harvest is of major importance. It is susceptible to both vector and virus and readily harbours both when present early enough.

Gast (R. T.), Guthrie (F. E.) & Early (J. D.). **Laboratory Studies on *Heliothis zea* (Boddie) and *H. virescens* (F.).**—*J. econ. Ent.* **49** no. 3 pp. 408–409, 3 refs. Menasha, Wis., 1956.

In North Carolina, cotton and tobacco are damaged by *Heliothis zea* (Boddie) and *H. virescens* (F.), often in mixed populations, and laboratory tests were made of the comparative toxicity of eight insecticides, applied topically to sixth-instar larvae of the two species at four or more dosages. The amounts in μg. per gm. body weight giving 50 per cent. kill in 48 hours were 4·8 and 4·8 for the two species, respectively, for Shell OS-2046 [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate], 40 and 54 for Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate], 30 and 60 for Bayer L13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate], 130 and 160 for malathion, 17 and 180 for endrin, 3,000 and 6,500 for DDT, 3,000 and 17,000 for DDD (TDE) and 2,000 and 18,000 for toxaphene. The differences in susceptibility between the two species may explain instances of poor control, since treatment intended against *H. zea* might not succeed against *H. virescens*, from which *H. zea* is not easily distinguished in the field [*cf.* also *R.A.E.*, A **45** 269].

Hyche (L. L.). **Control of Mites infesting Earthworm Beds.**—*J. econ. Ent.* **49** no. 3 pp. 409–410. Menasha, Wis., 1956.

The following is based on the author's introduction and summary. Commercial producers of earthworms for bait in Alabama have recently found large numbers of mites in the earthworm beds. Investigations in 1954 showed that *Caloglyphus anomalus* Nesbitt was the prevailing species, but *Macrocheles* sp. and *Parasitus* sp. were also present; the last two are predacious and might attack the worms. In tests in which potted soil containing mites and earthworms was sprayed with acaricides, Metacide [methyl-parathion and parathion], malathion and parathion effectively reduced mite populations, whereas Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] did not. All worms were still active in the pots seven days after treatment with 1 U.S. pint 50 per cent. Metacide emulsifiable concentrate or 2 lb. 15 per cent. wettable parathion per 100 U.S. gals. water, but malathion and higher concentrations of Metacide or parathion significantly reduced populations. When earthworm beds in production were sprayed with 1 pint 50 per cent. Metacide or 25 per cent. parathion per 100 U.S. gals., control of mites estimated at 80–90 per cent. was obtained with no evidence of dead earthworms.

Eden (W. G.). **The European Corn Borer in Alabama.**—*J. econ. Ent.* **49** no. 3 pp. 410–411, 4 refs. Menasha, Wis., 1956.

Pyrausta nubilalis (Hb.) was first reported in Alabama in 1950; it spread little until 1954, but had been found in 14 northern counties by the autumn of 1955. The first economic damage was to pimento pepper [*Capsicum*] in October 1954, when 25 per cent. of the pods were infested in some places. In 1955, 65 per cent. of the pods were damaged in some pimento fields and

over 60 per cent. of the stalks infested in many maize fields; up to 25 per cent. loss occurred in fields of grain sorghum.

On pimento, the eggs are laid on the leaves and the larvae bore into the pods and feed on both core and flesh. Preliminary experiments indicated that DDT would afford control. To determine the possible DDT residues in the canned product, pods were dipped in emulsions containing 2–4 lb. DDT per 20 U.S. gals., air-dried and canned. On analysis, no DDT was detected in them, and it is concluded that there would be none on processed pimentos, regardless of the amount of DDT applied in the field.

Investigations begun in June 1955 indicated that *P. nubilalis* has three complete generations a year in Alabama; the first two were confined to maize and the third occurred chiefly on sorghum and pimento.

Drooz (A. T.) & Benjamin (D. M.). **Parasites from two Jack-pine Budworm Outbreaks on the Upper Peninsula of Michigan.**—*J. econ. Ent.* **49** no. 3 pp. 412–413, 5 refs. Menasha, Wis., 1956.

Outbreaks of *Choristoneura pinus* Freeman occurred over about 6,000 and 1,200 acres of jack pine [*Pinus banksiana*] in the Upper Peninsula of Michigan in 1953. Examination of full-fed larvae and pupae collected in late July showed that the larvae were parasitised by *Zenillia* (*Aplomya*) *caesar* (Aldr.), *Z.* (*Phryxe*) *pecosensis* (Tns.), *Agria affinis* (Fall.) and *Glypta fumiferanae* (Vier.), and the pupae by *A. affinis*, *Apechthis ontario* (Cress.), *Gelis tenellus* (Say), *Itoplectis conquisitor* (Say), *Phaeogenes hariolus* (Cress.), *Ephialtes* (*Scambus*) *hispae* (Harris), *Amblymerus verditer* (Nort.), *Brachymeria ovata* (Say), *Habrocytus phycidis* Ashm. and *Syntomosphyrum esurus* (Ril.) [*cf. R.A.E.*, A **43** 237].

Charpentier (L. J.). **Systemic Insecticide Studies for Control of Vectors and Sugarcane Mosaic in Louisiana.**—*J. econ. Ent.* **49** no. 3 pp. 413–414, 1 ref. Menasha, Wis., 1956.

Carolinaia (*Hysteroneura*) *setariae* (Thoms.) is the most abundant of the vectors of sugar-cane mosaic in Louisiana [*cf. R.A.E.*, A **28** 249], and investigations on its control were carried out in 1952–54. In the first year, sprays of 1–2 U.S. pints Systox (48·1 per cent. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate]) in 20 U.S. gals. per acre on 5th June gave 95 per cent. control after 19 days, but practically none after 47. In 1953, sprays of 1 U.S. quart technical Metacide [methyl-parathion and parathion], schradan or Systox in 20 U.S. gals. per acre on 16th June resulted in 100, 78 and 100 per cent. control of the Aphid after one day and 0, 31 and 63 per cent., respectively, after 42. The insecticides appeared to have no effect on *Dysmicoccus* (*Pseudococcus*) *boninsis* (Kuw.), which persisted on the plants throughout.

In an attempt to discover whether the spread of the mosaic could be prevented by vector control, plots of sugar-cane planted in the autumn of 1953 and freed from infected stools were sprayed with 2 U.S. pints Systox in 30 U.S. gals. water per acre on 13th April and 10th and 29th May 1954. Examination on 20th May showed complete control of *C. setariae*, and examination on 28th May 80 per cent. control of this species and *Aphis* (*Rhopalosiphum*) *maidis* Fitch, but on 16th June, mosaic infection averaged 2·9 per cent., as compared with 2·1 per cent. in unsprayed plots.

Chemical analysis of samples taken, processed and frozen on 5th November from plants treated with 2 U.S. pints Systox (21 per cent. demeton) in 30 U.S. gals. water per acre on 10th and 30th April and 25th

May showed the presence of 2 parts Systox per million in molasses and sugar and 0·4 p.p.m. in the syrup.

Sferra (P. R.). **A preliminary Investigation of Breakdown of DDT in Granulated Formulations.**—*J. econ. Ent.* **49** no. 3 pp. 414–415, 1 ref. Menasha, Wis., 1956.

Granules of attapulgite, bentonite and tobacco (30–50 mesh), formulated commercially or in the laboratory by solvent impregnation or fusion to contain 10 per cent. DDT by weight, were analysed for DDT and degradation products. The results showed that the losses of DDT by decomposition immediately after fusion amounted to at least 40 and about 20 per cent. on attapulgite and bentonite, respectively, but there was negligible loss of DDT applied to tobacco by fusion or to tobacco or bentonite by impregnation. A commercial impregnated attapulgite preparation showed some loss, probably due to ageing, when examined after 24–29 months. Fused formulations thus appear to be less stable than solvent-impregnated ones. The heat (100–104°C.) applied during the fusion process evidently intensifies the incompatibility of attapulgite with DDT.

Yeomans (A. H.). **Tests to develop nonexplosive Mixtures of Solvents in Formulations for Use in Aerosol Generators.**—*J. econ. Ent.* **49** no. 3 pp. 415–416, 2 refs. Menasha, Wis., 1956.

Aerosol formulations containing a mixture of tetrachloroethylene and an inflammable solvent are cheaper than those for which tetrachloroethylene is the only solvent, and experiments have shown that they are equally insecticidal and generally more stable at low temperatures. Experiments were therefore carried out by a modification of the drum method previously used to ascertain the proportion of tetrachloroethylene necessary to prevent the aerosol from exploding [*cf. R.A.E.*, A **42** 224]. When 73 per cent. tetrachloroethylene was used with 15 per cent. inflammable solvent in mixtures containing 10 per cent. DDT and 2 per cent. γ BHC as lindane, no explosions occurred with nine of the ten solvents tested and there was an explosion in only one of five replications with the tenth, but all mixtures containing less than 59 per cent. tetrachloroethylene with 27·7–29·3 per cent. inflammable solvent resulted in explosion.

Bickley (W. E.), Harrison (F. P.) & Ditman (L. P.). *Drosophila* **as a Pest of canning Tomatoes.**—*J. econ. Ent.* **49** no. 3 pp. 417–418, 3 refs. Menasha, Wis., 1956.

Species of *Drosophila*, mainly *D. melanogaster* Mg., oviposit on ripe canning tomatos, mostly in growth cracks and breaks in the skin, and their eggs may persist in the canned product [*cf. R.A.E.*, A **43** 325]. Observations in Maryland in 1954–55 [*cf.* also next abstract], in which populations were estimated in various ways, showed that seasonal fluctuations occurred and that oviposition takes place mainly in the fields.

In the autumn of 1954, baskets of ripe tomatos, some with slits to attract egg-laying females, were sprayed with 0·55 per cent. malathion or 0·5 per cent. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] in emulsion sprays and examined for eggs after 24 hours. Both treatments materially reduced oviposition, Dilan

being slightly superior, and no changes in flavour were observed in the canned tomatos. Malathion, introduced into cans of whole fruit at the rate of 20–40 parts per million, to test its rate of breakdown, was practically unaffected after a week, indicating that any residues would persist for some time; however, tomatos are normally washed and peeled before canning, so that the amounts persisting would be small. Thorough spraying of baskets of tomatos with a mixture of 0·075 per cent. piperonyl butoxide and 0·0075 per cent. pyrethrins as they were loaded in the field, before removal to the factory and storage overnight, reduced the number of eggs found the following morning on five fruits, from which patches of skin had been removed, from 3,500 to 12 (on two fruits), and spraying again with pyrethrum and oil after the trucks were unloaded reduced it to two on a single fruit. The spray applied in the field killed most of the adults on the trucks and prevented the transport of large numbers to the factory. Pyrethrum sprays did not repel the flies, but spraying the baskets of tomatos with butoxy polypropylene glycol in water (1:9) did so, and reduced the number of eggs found 18 hours later from 1,000 to one per fruit.

Spraying growing tomato plants with 2 U.S. pints 50 per cent. malathion emulsion concentrate in 40 U.S. gals. per acre on 25th August and in 10 U.S. gals. per acre on 8th September did not reduce the number of eggs found on the fruits.

Bickley (W. E.). **Flies associated with Tomatoes in Maryland.**—*J. econ. Ent.* **49** no. 3 pp. 418–419, 5 refs. Menasha, Wis., 1956.

A list is given of ten species of *Drosophila*, other than *D. melanogaster* Mg., and one other Drosophilid that were collected in tomato fields or processing plants in Maryland, with notes on their frequency and habits. *D. melanogaster* is by far the commonest of the group [*cf.* preceding abstract], occurring in the fields in great numbers from mid-August until the onset of frosts, but several of the others are also known to oviposit on tomatos. The eggs of many Diptera are found on tomatos, but the only other flies that have been reared from the fruits in Maryland are *Musca domestica* L. and *Muscina assimilis* (Fall.), the second of which often oviposits on tomatos before they are picked; both breed in rotting tomatos. Other flies that are common in tomato fields and may sometimes oviposit on tomato are listed. Parasites of the genus *Aspilota* were reared from a culture of *D. melanogaster* in a field-collected tomato; this Braconid attacks small Diptera and is probably indiscriminate in its choice of hosts.

Semel (M.). **Polyhedrosis Wilt of Cabbage Looper on Long Island.**—*J. econ. Ent.* **49** no. 3 pp. 420–421, 10 refs. Menasha, Wis., 1956.

Infestation of cruciferous crops by *Trichoplusia ni* (Hb.) in Long Island was severe in 1955, and the larvae appeared to be resistant to DDT [*cf. R.A.E.*, A **45** 271]. A disease of the larvae was observed in mid-August and had become widespread by mid-September in Long Island and later in western New York. It was found to be due to a polyhedral virus, and earlier records of such infection in *T. ni* are briefly reviewed. Infected larvae became inactive and died after periods varying from about one day at high temperatures to six at low ones. The disease was rarely found in larvae in the first two instars, indicating that the later stages are more susceptible or that a period of virus multiplication is necessary. Repeated attempts to infect *Pieris rapae* (L.) and *Prodenia ornithogalli* Gn. with the virus by

oral or contact methods were unsuccessful, indicating that it may be specific to *T. ni.*

Ash (C. R.). **A lightweight Cage for Leaf feeding Insects.**—*J. econ. Ent.* **49** no. 3 pp. 421–422, 1 fig., 2 refs. Menasha, Wis., 1956.

The cage described consists of a light cylindrical plastic cell and a base, which are held on opposite sides of a leaf by means of two thin strips of bamboo, fastened across them and tied together at the ends.

Ditman (L. P.), Wiley (R. C.) & Giang (P. A.). **Residues and Flavors of Asparagus treated with Malathion.**—*J. econ. Ent.* **49** no. 3 p. 422, 2 refs. Menasha, Wis., 1956.

A spray of malathion in emulsion formulation or a mixture of malathion and Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] in the spring of 1954 apparently gave complete kill of the asparagus beetle [*Crioceris asparagi* (L.)] on asparagus in Maryland, and treatment with 2 U.S. pints 57 per cent. malathion emulsion concentrate per 25 U.S. gals. per acre in May 1955 resulted in residues of much less than the tolerance (8 parts per million) on the cut asparagus immediately after treatment and in no detectable residue after three days. Samples that were canned or frozen showed no residues and were not affected in flavour.

Brett (C. H.) & Campbell (W. V.). **Eggplant Lace Bug and Harlequin Bug Susceptibility to some standard Insecticide Dust Formulations.**—*J. econ. Ent.* **49** no. 3 pp. 422–423, 1 graph. Menasha, Wis., 1956.

The Tingid, *Gargaphia solani* Heid., is an important pest of egg-plant [*Solanum melongena*] in North Carolina, and various insecticides were compared for its control in laboratory tests. When adults in a jar were exposed to dusts for about ten minutes and then transferred to fresh leaves, 20 per cent. sabadilla gave complete mortality in four hours, 1 per cent. lindane [almost pure γ BHC] in about eight, and 4 per cent. malathion in 24; 10 per cent. toxaphene, 5 per cent. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] and 5 per cent. methoxy-DDT (methoxychlor) were progressively less toxic, but killed most of the insects in 24 hours, and DDT permitted 8 per cent. survival after 48 hours.

In similar tests with the Pentatomid, *Murgantia histrionica* (Hahn), the sabadilla dust gave complete kill of adults and last-instar nymphs in 8 hours and malathion in 24, but toxaphene caused no mortality in eight hours and only 64 per cent. in 48 [*cf. R.A.E.*, A **38** 26].

Hightower (B. G.) & Martin (D. F.). **Ecological Studies of Thrips found on Cotton in central Texas.**—*J. econ. Ent.* **49** no. 3 pp. 423–424, 1 graph, 3 refs. Menasha, Wis., 1956.

Thrips frequently become numerous on seedling cotton in central Texas and cause malformation of the plants [*cf. R.A.E.*, A **22** 635]. *Frankliniella tritici* (Fitch) and *F. fusca* (Hinds) are the main species concerned, and observations on their dispersion to cotton were made in 1954–55. Adhesive traps were set up in various situations, and it was found that *F. tritici* was active in lucerne fields in early March, when counts were

begun. Dispersion increased after 8th March in 1954 and reached a peak in mid-May. Small numbers of *F. exigua* Hood and *F. occidentalis* (Perg.) were taken during April–June, and *F. fusca* was caught from 28th March, its numbers reaching a peak in April but remaining small. Similar results were obtained in 1955, but the numbers of *F. exigua* were larger and those of *F. fusca* smaller. Movements of *F. tritici* and *F. fusca* were similar in fields of bur clover [*Medicago hispida*] and sweet clover [*Melilotus*]. Counts of thrips on seedling cotton showed that *F. fusca* predominated in both years, though *F. exigua* was almost as abundant in 1955; in 1954, *F. tritici* represented only 10 per cent. of the adult population until June, but later comprised 80 per cent. of it.

Hightower (B. G.) & Martin (D. F.). **Ecological Studies of Spider Mites attacking Cotton in central Texas.**—*J. econ. Ent.* **49** no. 3 pp. 424–425, 2 refs. Menasha, Wis., 1956.

Tetranychid mites are important pests of cotton in central Texas. *Tetranychus desertorum* Banks is the commonest in the area, but *T. telarius* (L.), *T. canadensis* (McG.) and *T. schoenei* McG. also occur. A study of their alternative food-plants and dispersion was made in 1954. Small colonies of *T. desertorum* were found on *Oenothera* sp., *Sonchus asper*, *Marrubium vulgare* and *Verbena bipinnatifida* in February, and large numbers occurred on bur clover (*Medicago hispida*) in March. In late April, the mites moved to *Ambrosia aptera* and seedling cotton. Other summer food-plants included *Monarda* sp., *Ipomoea* sp., *Xanthium* sp., and Johnson grass (*Sorghum halepense*). *Xanthium* was the main food-plant in October, and the mites left it for the winter food-plants in November and December. The green form of *T. telarius* [*cf. R.A.E.*, A **44** 20] was found only on ornamental plants in winter and spring, and the red form overwintered mainly on *V. bipinnatifida*. Populations of this mite increased slowly and reached a peak in July and August, the red form predominating on cotton in several fields in August and September. *T. canadensis* was found on *A. aptera* in spring and on *Xanthium* in summer; five examples were taken on cotton in October. *T. schoenei* was numerous on plum adjacent to a cotton field, but did not occur on the cotton.

Dominick (C. B.). **Control of Hornworms and Flea Beetles on Tobacco with Endrin and TDE.**—*J. econ. Ent.* **49** no. 3 pp. 425–426, 2 refs. Menasha, Wis., 1956.

Epitrix hirtipennis (Melsh.) and second-generation larvae of *Protoparce sexta* (Joh.) and *P. quinquemaculata* (Haw.) frequently injure late-maturing tobacco in Virginia, and endrin and DDD (TDE) were compared for their combined control in 1955 [*cf. R.A.E.*, A **42** 84; **43** 52]. Endrin was applied at 0·35–0·525 lb. per acre in dusts and 0·2 lb. in an emulsion spray, and DDD at 3·5 lb. per acre in a dust and 1 lb. in emulsion spray, on 5th August, when the temperature was 94°F.; sprays were applied by low-volume equipment. The *Protoparce* larvae were mainly in the last two instars, and *P. sexta* comprised 90 per cent. of the population. Counts made before and 24 and 48 hours after treatment showed that endrin in dust or spray gave higher initial kill of *Protoparce* than did DDD, but all treatments gave 95–98 per cent. mortality in 48 hours. Endrin in spray or dust gave 98–99 per cent. control of *E. hirtipennis* in 24 hours, whereas the DDD spray and dust gave 68 and 93 per cent., respectively.

Kerr jr. (T. W.). **Control of the Pine Spittlebug and the Pine Needle Miner.**—*J. econ. Ent.* **49** no. 3 p. 426, 1 ref. Menasha, Wis., 1956.

Exoteleia pinifoliella (Cham.) and *Aphrophora parallela* (Say) have increased in abundance on pines in Rhode Island since 1952 and 1953, respectively; both have been collected from pitch pine and jack pine [*Pinus rigida* and *P. banksiana*], and the latter also from Scots pine and red pine [*P. sylvestris* and *P. resinosa*]. They are particularly abundant on *P. rigida*, and insecticides for their control were tested on this species in 1955.

Nymphs of *Aphrophora* were present from 11th May and adults from 27th June, and wettable-powder sprays of 2 lb. 50 per cent. DDT or methoxy-DDT (methoxychlor), 1 lb. 25 per cent. malathion or 50 per cent. dieldrin, or 0·5–1 lb. 25 per cent. lindane [almost pure γ BHC] per 100 U.S. gals., all with Triton B-1956, applied on 15th June to trees 15 ft. in height, gave 95–100 per cent. control by 23rd June.

Larvae of *Exoteleia* overwintered in the needles and resumed feeding in late March. Many had migrated to uninjured needles by 16th April, and most had pupated by 16th May. Adults were abundant by 1st July but had disappeared by 22nd July; there was only one generation in the year. Sprays were applied on 15th or 27th June or 14th July, and counts between 20th September and 6th October showed that the percentages of needles mined were 2·1–8·2 for 0·5–1 lb. 50 per cent. dieldrin per 100 U.S. gals., 6·2–12·5 for 1–2 lb. 50 per cent. DDT, 10·5–18 for 2 lb. 50 per cent. methoxy-DDT, and 27·1–38·9 for 0·5–1 lb. 25 per cent. γ BHC, as compared with 34·2 for no treatment.

Chapman (J. A.) & Wilson (J. W.). **The Use of impregnated Paper as an Approach to nutritional Studies with the Douglas-fir Beetle.**—*J. econ. Ent.* **49** no. 3 pp. 426–427, 6 refs. Menasha, Wis., 1956.

Investigations on the food requirements of *Dendroctonus pseudotsugae* Hopk. were carried out in Canada by confining adults with chemically defined papers to which starch, pectin or various sugars had been added. The papers were crumpled and moistened with distilled water, and compared for extent of burrowing activity, situation of living beetles at the end of the test, production of excreta and survival time. Analysis of the results indicated that the beetles showed a preference for any carbohydrate over none, but did not distinguish between them. They ate only small amounts of the papers, which were soft and contained little roughage compared with bark, and fed for only a few days.

Griswold (C. L.). **Interval between Oak Wilt Fungus Inoculation by *Drosophila melanogaster* and Appearance of foliar Symptoms.**—*J. econ. Ent.* **49** no. 3 p. 429, 2 refs. Menasha, Wis., 1956.

In tests in Ohio in 1953–54 on the transmission of *Endoconidiophora fagacearum*, the fungus that causes oak wilt, by *Drosophila melanogaster* Mg. [*cf. R.A.E.*, A **42** 303], adults were allowed to feed on the moisture at the tips of the hyphae on sporulating mats of the fungus producing endospores only and then on fresh artificial wounds in the xylem of healthy oaks. Infection resulted in all of 16 seedlings in pots and in one tree 40 years old, probably on the first day of infestation, when feeding activity was greatest. The mature tree and 12 of the seedlings, infested between 1st April and 2nd August, developed leaf symptoms in June–September of the

same year, 18–71 days later, and the remainder, infested between 20th July and 8th October, showed symptoms in June of the next year, 243–330 days later.

Ellertson (F. E.). *Pleocoma oregonensis* **Leach as a Pest in Sweet Cherry Orchards.**—*J. econ. Ent.* **49** no. 3 p. 431, 2 refs. Menasha, Wis., 1956.

Lamellicorn larvae found feeding in Oregon on the roots of apple and pear in September 1953 and on those of cherry in March–April 1954 were identified as *Pleocoma crinita* Linsley and *P. oregonensis* Leach, respectively. Large larvae of *P. oregonensis* were observed on roots of various sizes, but small ones were associated with rootlets and root hairs; some trees were killed by the attack. In mid-September, the large larvae were found in cells at depths of 8–37 ins. in the soil under the trees. Males were on the wing during the early morning or late afternoon in October and November, and entered the burrows occupied by the females, which were usually within 5 ins. of the soil surface, up to nine being attracted to individual females and some being crushed in the process. Two fertilised females placed in soil cages 4 ft. deep in November 1954 had burrowed to the bottom by mid-July 1955; one deposited 35 and the other 48 eggs, and hatching occurred from 25th July to 2nd August. Adults were observed in numbers in two cherry orchards, a stand of western yellow pine [*Pinus ponderosa*] and sagebrush grassland.

Alfaro (A.). **Los barrenadores del maíz en las vegas medias del Ebro.** [The Maize Borers in the central Plains of the Ebro.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 1–17, 12 figs., 8 refs. Madrid [1956].

Since 1951, when American hybrid maize began to be widely grown in the plains of the Ebro, in eastern Spain, infestation by *Sesamia nonagrioides* (Lef.) has increased considerably, and this pest, which had not previously been recorded from Aragon, is now of more economic importance than *Pyrausta nubilalis* (Hb.), the other maize stem-borer present in that region. In the autumns of 1953–54, after the ears had been harvested, 32–100 per cent. of the plants, with an average of 75 per cent., were found to be attacked by borers, of which 90 per cent. were *Sesamia*. Some 30 per cent. of the ears in one area were also infested. In general, American hybrids were more severely attacked than the local varieties. About two-thirds of the *Sesamia* larvae were found in the stalks and the remaining third in the underground parts of the plants; 87 and 33 per cent. of these, respectively, died from exposure to cold during the winter when the stubble was left standing in the field, and this mortality was probably responsible for the reduction in infestation observed in some places in 1954.

In that year, adults of the overwintering generation of *Sesamia* began to emerge in late April from stalks that had been somewhat protected from the weather. Pairing and oviposition began immediately after, and the eggs were laid on the inner surface of the leaf sheath. In 1952, newly formed pupae were observed from 27th June to 20th July, and the pupal stage lasted some 10–18 days, with an average of 14·8, the adults emerging from 4th July to 4th August. The females, which formed one-third of the population, laid 13–357 eggs each, with an average of 155, in groups of 13–270, but dissected females contained many more eggs than were actually laid. Larvae that hatched on 17th July became full-fed in about 35–40 days; the pupal stage lasted a fortnight, and adults emerged about 3rd–7th

September. It appeared possible, therefore, for a partial third generation to develop in that year.

P. nubilalis is considerably less injurious than *S. nonagrioides*. The larvae also overwinter in the maize stalks and roots, adults appearing in May–June. The eggs are laid in small groups on the leaves, and egg mortality is high. In upland regions, the full-fed larvae remain in diapause until the following spring, but at lower altitudes, where the climate is milder, there is a second generation in the year.

The damage caused by the two borers is described. In Aragon, *S. nonagrioides* has been found almost exclusively on maize, but *Pyrausta* was observed attacking other plants, including sorghum, hemp and *Dahlia*. For control, the removal and burning of all crop remains after harvest is essential.

Alfaro (A.). **Notas sobre el garapatillo del trigo** *Aelia rostrata* **Boh., en Aragón.** [Notes on *A. rostrata* on Wheat in Aragon.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 19–37, 16 figs., 6 refs. Madrid [1956].

Aelia rostrata Boh. attacks wheat in various regions of Spain, and its distribution in the Provinces of Saragossa, Huesca and Teruel is shown on a map. In this area, the intensity of attack varies from year to year, but losses are sometimes considerable. The nymphs and adults of this Pentatomid suck the grains in all stages of development, but preferably while they are in the milky stage, causing them to shrivel, and the flour milled from injured grains is of inferior quality. The adults overwinter in protected sites in the open [*cf. R.A.E.*, A **26** 697] and migrate to wheat and sometimes barley in late April or early May. The females oviposit in May on dry leaves at the base of the plants or on the ground, but rarely on the upper parts of the plants, and usually lay their eggs in groups of 8–15. In the laboratory, the egg stage lasted 15 days at average temperatures of 16·5–17·5°C. [61·7–63·5°F.], six days at 22·5–24°C. [72·5–75·2°F.] and five days at 22–25·75°C. [71·6–78·35°F.]. On wheat in a field cage, the five nymphal instars, which are described, were completed in 25 days in May–June. The eggs of *A. rostrata* are sometimes heavily parasitised by *Telenomus* sp., and 15 per cent. of the adults in one area were parasitised by *Gymnosoma rotundatum* (L.) [*cf.* **26** 698], the larvae of which left the dead host to pupate in the soil. Adult parasites appeared in the second half of June. Adults of both the overwintering and the first generation of *A. rostrata* were attacked.

Control measures, including early sowing, are briefly reviewed [*cf.* **32** 179, etc.], and the results are given of tests with synthetic organic insecticides. In the first, adults were placed in groups of 15 on ears of wheat that had been sprayed with 0·075 per cent. DDT or 0·225 per cent. BHC and left to dry. The numbers living after three days were 1 and 0, respectively, as compared with 12 for no treatment. In the second, second-instar nymphs were placed in similar groups on wheat sprayed with 0·05 per cent. DDT, 0·025 per cent. lindane [almost pure γ BHC], 0·0375 per cent. dieldrin, 0·0575 per cent. aldrin and 0·1 per cent. chlorinated terpenes, all in emulsion form. Mortality was complete in two days for all materials except the last, which allowed one nymph to survive. In the controls, 12 nymphs were still living. In a third test, ears of wheat and barley were sprayed with 0·08 per cent. DDT, 0·16 per cent. chlorinated terpenes, 0·02 per cent. γ BHC, 0·03 per cent. dieldrin and 0·0625 per cent. malathion in emulsion form and infested with second- and third-instar nymphs; the numbers (out of 15) still living after two days were 0, 0, 0, 5 and 1, respectively, as compared with nine for no treatment. In a similar test against last-instar

nymphs, the numbers still living and (in brackets) dead after four days, as compared with 17 (8) for no treatment, were 2 (21), 4 (17), 1 (24), 0 (25) and 0 (25) for emulsion sprays containing 0·1 per cent. DDT, 0·02 per cent. γ BHC, 0·03 per cent. dieldrin, 0·046 per cent. aldrin and 0·05 per cent. malathion, respectively, and 6 (17), 0 (24) and 2 (23) for dusts containing 5 per cent. DDT, 1·1 per cent. γ BHC and 10 per cent. chlorinated terpenes, respectively. When sheaves of wheat, under which many bugs were sheltering, were treated in the field, the best results were given by the γ BHC dust, and BHC also proved effective when applied in a dust or a suspension spray to a severely infested field.

Alfaro (A.). **Los *Hoplocampa* del peral y del ciruelo. (Datos biológicos y ensayos de lucha química.)** [*Hoplocampa* spp. on Pear and Plum. (Information on Bionomics and Experiments on chemical Control.)]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 39–58, 13 figs., 7 refs. Madrid [1956].

Considerable damage is caused in some years to pear by *Hoplocampa brevis* (Klug) in the Province of Saragossa. This sawfly has one generation a year, and notes are given on its bionomics as observed in 1954–55, together with an account of experiments on its control. In laboratory tests, all the young larvae present and those that hatched subsequently from the eggs were killed in five days when drops of an emulsion containing 0·069 per cent. BHC or 0·028 per cent. parathion were placed in the receptacle of individual flowers or brushed on to the calyx over the site of oviposition, and when flowers containing eggs and young larvae were dipped in a suspension of 0·15 per cent. BHC.

In a field test, trees in full bloom were treated on 30th March 1954 with an emulsion spray of 0·2 per cent. chlorinated terpenes or suspension sprays of 0·1 per cent. DDT, 0·225 per cent. BHC or 0·032 per cent. lindane [almost pure γ BHC]. The percentages of pears attacked at counts on 20th April, before the damaged fruits began to fall, were 0·6, 12·7, 6·8 and 4·5, respectively, as compared with 18 for no treatment, and examination showed that the larvae had been killed before they could enter the fruits. On 30th May, the percentages of fallen fruits attacked were 0, 59, 6 and 0 for the four products, respectively, as compared with 96 for no treatment. In another test, sprays were applied on 29th March to an early variety at the petal-fall stage and to a late variety in full bloom. Some 36 per cent. of the eggs had already hatched. By 21st April, 40 per cent. of the fruits of the early variety sprayed with 0·1 per cent. DDT had been attacked, as compared with 59 for no treatment, and the corresponding percentages for the later variety were 10 for 0·225 per cent. BHC or 0·032 per cent. γ BHC, 14 for 0·2 per cent. chlorinated terpenes and 23 for 0·1 per cent. DDT, as compared with 34 for no treatment.

In 1955, sprays were applied to the same two varieties, on 29th March, treatment being followed by rain. Counts of the fallen fruits were made on 4th May, by which date all those attacked had fallen. The infestation percentages for the early variety, as compared with 60 for no treatment, were 14 for 0·2 per cent. chlorinated terpenes, 28 for 0·02 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] and 45 for 0·06 per cent. DDT. The corresponding percentages for the late variety, as compared with 26 for no treatment, were 1 for 0·015 per cent. γ BHC in emulsified solution, 3 for 0·032 per cent. γ BHC in suspension, 6 for 0·035 per cent. parathion in emulsion, 7 for 0·15 per cent. BHC in suspension and 0·05 per cent. O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate in emulsion and 8 for 0·08 per cent. BHC in emulsion.

H. minuta (Christ) and *H. flava* (L.) cause considerable damage to plum, chiefly late varieties, in the same area, and notes on their bionomics are given. Sprays for their control should be applied at the end of petal-fall, when the larvae begin to hatch, but infestation in 1955 was too light for comparison of insecticides to be made.

ALFARO (A.). **Observaciones sobre *Cydia pomonella* (L.) y su tratamiento en 1954 y 1955.** [Observations on *C. pomonella* and its Control in 1954 and 1955.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 59–70, 4 graphs, 2 refs. Madrid [1956].

Investigations on the bionomics and control of *Cydia pomonella* (L.) on apple near Saragossa [*cf. R.A.E.*, A **44** 258, etc.] were continued in 1954–55. In the first of these years, emergence of adults from overwintering pupae kept in outdoor cages began about 10th May and reached its peak about 10th June. Adults of the first generation were most numerous about two months later. Open pots containing 8 per cent. molasses with the addition of 0·1 per cent. of a saturated solution of geraniol crystals in alcohol [*cf.* **44** 82] were used to trap adults in the orchards, and moths were taken from early May to mid-September, with maximum numbers in early June and mid-July. When sprays were applied on 9th June, 6th July (followed by rain), 15th July and 25th August, the percentages of apples infested, including fallen ones, were 16 for 0·75 per cent. lead arsenate, 31 and 61 for emulsion sprays of 0·035 per cent. parathion and 0·23 per cent. aldrin, respectively, 71 for 0·24 per cent. chlorinated terpenes, 80 for 0·84 per cent. mineral-oil emulsion and 86 for 0·158 per cent. dieldrin in an emulsion. The corresponding percentages were 25–33 for 0·02 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] in suspension sprays applied on 23rd June, 6th and 15th July and 25th August, 66 for the lead-arsenate spray on 9th June followed by Diazinon spray on 6th and 15th July and 25th August, and 77 for the Diazinon spray alone on these last three dates.

In 1955, adult emergence began on 5th May, with maxima in the second and third decades of that month, and peak numbers were taken in the bait-traps in mid-June. Sprays were applied on 23rd May, 8th and 20th June, 19th July and 8th August, and the percentages of apples found infested, including fallen fruits, on 2nd September were 22 and 52 for 0·75 per cent. lead arsenate and 0·02 per cent. Diazinon, respectively, and 54 for an emulsion spray of 0·1 per cent. malathion.

ALFARO (A.). **La arañuela roja y su tratamiento.** [The Red Spider and its Control.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 71–84, 6 figs., 7 refs. Madrid [1956].

The author reviews the bionomics of *Tetranychus telarius* (L.) and states that this mite is injurious to many plants in the valley of the Ebro and particularly to cotton, losses of up to 70–80 per cent. of the yield of the latter being usual in hot, dry summers. Tests on control were carried out on cotton and soy beans. When sprays were applied at the rate of about 45 gals. per acre to both plants in plots, better results were given by 0·8 per cent. wettable sulphur than by 0·02 per cent. derris extract, and the wettable-sulphur spray at about 68 gals. per acre was better than a sulphur dust at about 77 lb. per acre. In all tests, the sulphur spray resulted in high mortality of active stages. When the sulphur dust was compared on cotton with emulsion sprays of 0·014 and 0·028 per cent. parathion, 36, 93

and 98 per cent. of the mites died in three days, respectively, as compared with 6 per cent. for no treatment. The parathion deposits maintained their full effectiveness for six days, when the control given by sulphur had somewhat improved. In another test, the mortality percentages after two and four days, respectively, were 52 and 87 for the sulphur dust, 95 and 85 for the 0·014 per cent. parathion spray and 8 and 3 for no treatment. When various sprays were applied to cotton at the rate of 153 gals. per acre, the mortality percentages after two, four and ten days, respectively, were 52, 43 and 63 for 0·4 per cent. wettable sulphur, 69, 83 and 78 for 1 per cent. white summer-oil emulsion, 92, 61 and 41 for 0·014 per cent. parathion, 92, 91 and 99 for 0·02 per cent. diethyl 2-(ethylthio)ethyl phosphorothioate [demeton] with polyethyleneglycol ether, and 76, 30 and 57 for 0·02 per cent. derris extract, as compared with 10, 7 and 13 for no treatment. Parathion at 0·014 per cent. was further compared with a product containing 22·5 per cent. 2,4-dinitro-6-(1-methylheptyl)phenyl crotonate and 2·5 per cent. other nitrophenols, applied at 0·12 per cent. in a suspension spray, and the mortality percentages were 93 and 88 after three days, respectively, and 94 and 88 after seven, as compared with 3–4 per cent. for no treatment. In a further test on cotton, the mortality percentages after two and five days, respectively, were 88 and 81 for 0·014 per cent. parathion, 86 and 88 for the dinitro product at 0·12 per cent., 78 and 75 for an emulsion spray of 0·175 per cent. O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate, 77 and 67 for an emulsion spray of 0·07 per cent. p-chlorophenyl p-chlorobenzenesulphonate and 47 and 70 for a suspension containing 0·07 per cent. of the same material, as compared with 17 and 8 for no treatment. The last-mentioned product showed some ovicidal effect. When leaves were removed from cotton plants and treated in the laboratory with the sprays used in the last test, all products gave 86–98 per cent. mortality in two days and 95–100 per cent. in four, indicating that irregularities in spraying may partly account for variations in the results obtained in the field.

Alfaro (A.). *Mayetiola destructor* **Say y** *Mayetiola mimeuri* **Mesnil, en Zaragoza.** [*M. destructor* and *M. mimeuri* in Saragossa.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 85–116, 28 figs., 5 refs. Madrid [1956].

Mayetiola destructor (Say) is widely distributed on wheat and rye in Spain and is one of the most injurious pests of wheat in parts of Aragon, though the intensity of attack varies from year to year. The distribution of this Cecidomyiid in the Provinces of Saragossa, Huesca and Teruel is given and all stages are briefly described. Damage was severe in 1951–53 in the district of Monegros, in Saragossa, and extended into the Province of Huesca. Wheat was sown early in the autumn of 1951 and germinated without delay, owing to abundant rain, so that favourable conditions were provided for the development of *M. destructor*, oviposition by which was heavy on the young plants. The stubble of the previous crop, which harboured many pupae, had not been ploughed in before the wheat was sown, and this also favoured infestation.

Small numbers of adults developed in field cages in May 1952, and large numbers emerged between late September and early November, with a peak in the first ten days of October. Only wheat sown in the first half of October 1952 developed sufficiently to be attacked in the field, as the remainder of the autumn was dry. Larvae that had remained in diapause from the previous year gave rise to adults in the cages in March–April 1953, but one remained in diapause until the autumn. Small numbers of adults of the first generation appeared in May–July, following rain, but most of the larvae

remained in diapause throughout the summer and gave rise to adults in October, after the September rains. Wheat sown in late September was heavily attacked, but that sown after mid-October was less severely infested. Large numbers of adults emerged in March 1954, following spring rains, but the rest of the year was abnormally dry, so that few adults appeared in autumn and most of the larvae remained in diapause until February–April 1955. When the stand of wheat is good, as is usual in irrigated fields, losses due to *M. destructor* are of little importance, but where other factors, such as scarcity of rain, reduce the stand, the attack assumes more significance.

The females of *M. destructor* begin to oviposit immediately after pairing, laying their eggs on the leaves. In the autumns of 1952 and 1953, the egg stage lasted 4–8 and 5–24 days, respectively. In 1953, caged females of the overwintering generation laid 5–101 eggs each, but survived for only 1–2 days, whereas those caged in February 1955 lived for 4–5 days. In the autumn of 1952, the active larval stage lasted about six weeks. Insecticide treatment against the Cecidomyiid is not practicable, but infestation can be prevented by postponing sowing, so that germination begins after the autumn generation has developed, the rotation of wheat with less susceptible crops, such as barley, and the ploughing in of the stubble from the previous crop [*cf. R.A.E.*, A **30** 480]. Fields that have been abandoned owing to heavy attack in the early part of the year should be ploughed in deeply before March, to reduce emergence of the overwintering generation.

M. mimeuri (Mesnil) was observed, for the first time in Spain, infesting a field of barley near Saragossa in the spring of 1954. Neighbouring wheat was not attacked, but a few puparia were found on rye. All stages of this Cecidomyiid are briefly described. Barley plants bearing puparia were caged in the field in June, and adults emerged in November–April. Pairing occurred immediately after, and the females oviposited on the leaves of barley, laying their eggs singly or in groups of 3–4 [*cf.* **42** 357]. Three females laid 196, 117 and 20 eggs, respectively, and on dissection were found to contain a further 18, 50 and 151. The larvae hatched in 6–26 days and migrated to the bases of the plants, on which they formed swellings [*cf.* **23** 145; **42** 357]. Adults that emerged in the autumn of 1954 and early in 1955 were caged on wheat and barley. Wheat was not attacked, but infestation developed on the barley, the first adult of the next generation emerging on 26th March. There appeared to be two generations a year. Infested plants were also attacked in the field by the fungus, *Helminthosporium sativum*. The only other species of *Mayetiola* on cereals in Spain is *M. avenae* (Marchal), which infests oats, and a key enabling all three species to be differentiated in the larval and adult stages is appended.

Planes (S.) & del Rivero (J. M.). **Nuevos estudios sobre el barrenador del arroz.** [New Studies on the Rice Borer.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 117–144, 10 figs., 1 graph, 1 fldg. table, 4 refs. Madrid [1956].

Experiments on the control of *Chilo suppressalis* (Wlk.) on rice in Valencia [*cf. R.A.E.*, A **43** 286] were continued in 1952–53. The toxicity of various insecticides was investigated in the laboratory by placing larvae on pieces of treated rice stalk or filter paper. The best results were given by 0·1 per cent. DDT (alone or with BHC), malathion and parathion in emulsion sprays and by DDT (alone at 6 per cent. or at a lower concentration with BHC) and a mixture of BHC and cryolite in dusts. Several light-traps, incorporating mercury-vapour lamps or fluorescent tubes, were tested in the field, and a graph is given showing the numbers of *Chilo* taken in

them between late June and early September 1953. Peak numbers were observed in mid-August, and the results were suitable for timing the application of control measures. In field tests in 1952, only 0·1 per cent. DDT, alone or with BHC in an emulsion spray, substantially reduced the infestation, but the dust mixture of BHC and cryolite gave fair control. In 1953, two applications of DDT in an emulsion spray again gave the best results, but parathion appeared promising. Better results were obtained with power sprayers than with knapsack apparatus, though the use of the former in rice-fields is often difficult or impossible. It is thought that two applications 15–18 days apart would give better results than two at the interval of 30 days adopted in these tests. Flooding the fields for several months after harvest [*cf.* **43** 287] again reduced infestation of the succeeding crop. Tests were also made in which dusts were applied from an aeroplane flying at a height of only a few feet, and it was found that the reductions in infestation afforded by the mixtures of BHC with DDT or cryolite were considerably greater than when applications were made from the ground.

Planes García (S.) & del Rivero (J. M.). **Primeros ensayos contra *Ceratitis capitata* y *Dacus oleae* por medio de cebos azucarados con insecticidas fosfóricos.** [First Tests against *C. capitata* and *D. oleae* with sweetened Baits containing Phosphorus Insecticides.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 145–163, 6 figs., 4 fldg. tables, 4 refs. Madrid [1956].

Bait-sprays containing phosphorus insecticides of low mammalian toxicity were tested for the control of *Ceratitis capitata* (Wied.) on orange in Valencia in the autumn of 1954, malathion, Diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate), Chlorthion (O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate) and Dipterex (dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate) being compared with parathion. DDT and lindane [γ BHC] as standards. The insecticides were applied in sprays, usually containing in addition 5 per cent. sugar or 4 per cent. ammonium phosphate, or both, to an area of about 1–1·5 sq. yards of foliage on the side of the tree most exposed to the sun, at the rate of 200–500 cc. per tree, and dead flies that dropped on to sheets spread beneath the trees were counted.

In the first test, in which Dipterex was not included, the sprays contained sugar and were applied on 24th November, and it was found that malathion at 0·3 per cent. in emulsion or wettable-powder sprays was greatly superior to all the other products; it remained effective for about a fortnight, and also killed other Diptera. In the second test, in which Dipterex was included, the sprays were applied on 4th December. Dipterex at 0·3 and 0·15 per cent. and malathion at 0·3 per cent., all in emulsion sprays with the addition of sugar, gave the best results, whereas Dipterex alone or with both sugar and ammonium phosphate and malathion without sugar were very much less effective. Chlorthion at 1·5 per cent. in a wettable powder with sugar was moderately effective.

In similar tests against *Dacus oleae* (Gmel.) on olive, sprays containing Dipterex, malathion, chlorthion, DDT and γ BHC with sugar were applied in late November and early December. The best results were given by Dipterex at 0·3 per cent. in an emulsion spray, but some control was also afforded by malathion at 0·3 per cent. The other materials resulted in poor kills. There were no significant differences between the numbers of eggs in females of *Dacus* taken in bait-traps and those collected on the sheets, and the same was true for *C. capitata*.

Gómez-Menor Guerrero (J. M.). **Un mírido que ataca al tomate y al tabaco.** [A Mirid that attacks Tomato and Tobacco.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 193–200, 5 figs., 15 refs. Madrid [1956].

The author describes all stages of *Macrolophus nubilus* (H.-S.), and reviews its systematic position, distribution and food-plants. It was recently observed feeding on the leaves and young shoots of tomato in the Canary Islands and was also taken on tomato and tobacco in Spain.

Gómez-Menor Ortega (J.). **Hemípteros que atacan a los árboles y arbustos frutales.** [Hemiptera that attack Fruit Trees and Bushes.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 209–282, 42 figs., 35 refs. Madrid [1956].

This paper is concerned chiefly with the Heteroptera that are injurious to fruit trees and bushes and to vines in Spain, but species that are predacious on pests of fruit are included. Keys are given for their identification, together with brief descriptions of 29 injurious species and notes on their bionomics, food-plants and distribution.

del Cañizo (J.). **Un tisanóptero perjudicial a los frutos de la platanera en las islas Canarias.** [A Thrips attacking Banana Fruits in the Canary Islands.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 283–291, 2 figs., 14 refs. Madrid [1956].

Discoloration of the skin of bananas from the islands of Tenerife and Gran Canaria was found to be caused by the feeding of *Hercinothrips femoralis* (Reut.), and the adults of both sexes of this thrips are briefly described. Secondary infection by the fungus, *Gloeosporium musarum*, developed in some cases when injured fruits were kept in a damp room. The distribution, food-plants, bionomics and control of *H. femoralis* are reviewed from the literature, and characters are given distinguishing the adults from those of *H. bicinctus* (Bagn.).

Alfaro (A.). **Los productos orgánicos de síntesis en la defensa de las plantas cultivadas.** [Synthetic organic Products for the Protection of cultivated Plants.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 293–341, 114 refs. Madrid [1956]; also in *Bol. Asoc. nac. Ing. agrón.* nos. 47–48, repr. 16 + 12 pp., 109 refs. [? Madrid] 1954.

The author reviews the composition, common names, properties and uses of the principal modern organic insecticides, acaricides and fungicides employed for plant protection, and gives their structural formulae.

Domínguez García-Tejero (F.). **Halticinos de interés agrícola.** [Halticids of agricultural Interest.]—*Bol. Pat. veg. Ent. agric.* **21** (1954–55) pp. 343–393, 12 figs., 33 refs. Madrid [1956].

A key is given, based on adult characters, to the ten genera of Halticids that are of economic importance in the Mediterranean region. Brief descriptions are given of the injurious species, together with notes on their distribution, with special reference to Spain, and on their food-plants, bionomics and control.

Distribution Maps of Insect Pests.—Series A, nos. 73–78. London, Commonw. Inst. Ent., 1957.

These maps are nos. 73–78 of a series already noticed [*R.A.E.*, A **40** 203; **44** 467] and deal, respectively, with *Orthezia insignis* Browne, *Dacus oleae* (Gmel.), *Hylemyia antiqua* (Mg.), *Clysiana ambiguella* (Hb.), *Cryptotermes brevis* (Wlk.) and *Phyllocoptruta oleivora* (Ashm.).

Raucourt (M.), Viel (G.) & Ventura (E.). **La lutte chimique contre les chenilles défeuillantes du pommier à cidre.**—*Ann. Épiphyt.* **7** no. 3 pp. 363–396, 17 figs., 18 refs. Paris, 1956.

Investigations were made in northern France in 1950–53 on the value of DDT and BHC dusts against Lepidopterous defoliators of cider-apple trees [*cf. R.A.E.*, A **42** 33]. The pests considered were *Hyponomeuta padellus malinellus* Zell. and *Operophtera brumata* (L.), and notes on their bionomics are included. Preliminary tests were carried out on single trees to determine the toxicity of the products to the larvae. Against *Operophtera*, the dusts were applied at about 54 lb. per acre (about 1·32 lb. per tree) and a lead-arsenate spray containing 1 lb. arsenic (As) per 100 gals. was applied for comparison at about 2·2 gals. per tree. The treatments were applied on 21st May, towards the end of the larval stage, and mortality counts were made for 4–5 days afterwards. The percentages of larvae found to be dead or moribund averaged 83 and 88 for dusts containing 5 and 12 per cent. DDT, respectively, 33 for 10 per cent. BHC and 97·5 for the lead-arsenate spray. Treatments applied on 12th May against larvae of *Hyponomeuta* in the mining stage were completely ineffective, but dusts of 10 per cent. DDT or BHC at about 0·55 lb. per tree, and the lead arsenate spray at 1·65 gals. per tree, applied on 25th May when the larvae had left their mines but had not yet formed webs, gave mortality percentages, calculated according to Abbott's formula [**13** 331], of 98, 70 and 78, respectively, in a week. In a further test, applications were made on 5th June against the larvae in their webs, DDT being used at 5 and 10 per cent. and BHC at 8 and 10 per cent. in dusts applied at about 0·44 lb. per tree, and the lead-arsenate spray being applied at about 7 pints per tree. On 10th June, the mortality percentages, calculated as before, averaged 81 for DDT, 68 for BHC and 100 for lead arsenate. The amounts of insecticide deposited on the leaves were determined by exposing strips of aluminium foil or filter paper in the trees before treatment and subsequently analysing them in the laboratory. Details are given of the results in the tests against *Hyponomeuta*, from which it is concluded that, at the rates obtained (about 10–15 μg. per sq. cm. of leaf), DDT is more effective than BHC.

A field test against *Operophtera* was carried out in half of an orchard of nearly ten acres, having about 40 trees per acre. A dust of 8 per cent. DDT was applied from a power duster on 20th May, when all the larvae had hatched but none had pupated, the rate of application being about 45 lb. per acre, though applications to individual trees were varied according to their size. Watch glasses smeared with oil were exposed before treatment, to determine the amounts of dust deposited on the foliage in different parts of the trees. It was found that some 80 per cent. of the leaf area received more than 5 μg. DDT per sq. cm., which is considered adequate, and that 62 per cent. of the actual DDT applied was deposited on the foliage. Counts of dead and moribund larvae, carried out as in the preliminary tests, showed a total mortality of 95·75 per cent. When untreated larvae were placed on treated foliage 0, 4 and 8 days after dusting, the mortality percentages were 78, 52 and 8, respectively, as compared with 0–6 for no treatment.

A brief account is also given of a further experiment in which two orchards were dusted with 10 per cent. DDT at 49·5–52·2 lb. per acre from a Piper Cub aeroplane, on 13th March, when the larvae of *Operophtera* were mainly in the fourth and fifth instars. The wind speed at the time of treatment was about 2·2–4·4 miles per hour, with occasional gusts of up to 13 m.p.h. The amounts of DDT deposited on the leaves averaged 0·52 μg. per sq. cm., which represented 9 per cent. of the actual DDT applied. There was considerable variation in the mortality of the larvae on the sample trees examined, and this is attributed to some trees being missed or partly missed during treatment. Of ten trees examined in one of the orchards, mortality was 0–5 per cent. on six, 60–65 per cent. on two and 90–100 per cent. on the remaining two. In the second orchard, it was 0–10 per cent. on two trees and 80–90 per cent. on the five others examined.

The authors briefly review literature on the effects of DDT on dairy cattle and their milk [*cf.* **37** 339, 346] and show that the amounts likely to be ingested by animals grazing beneath trees dusted for the control of *Operophtera* and *Hyponomeuta* are well below the minimum lethal dosage, but might result in some contamination of their milk. Dairy cows should therefore be excluded from orchards for one week following treatment.

Féron (M.) & Audemard (H.). **Notes sur** *Hydrellia griseola* **(Dipt. Ephydridae), mouche mineuse du riz en France.**—*Ann. Epiphyt.* **7** no. 3 pp. 421–430, 4 figs., 11 refs. Paris, 1956.

Considerable damage has been caused in recent years to rice in southern France by *Hydrellia griseola* (Fall.) which was first recorded attacking the crop in 1951 and was erroneously referred to in the same year as *H. incana* (Stenh.) [*cf. R.A.E.*, A **42** 132]. Observations showed that the plants are attacked when they show 3–4 leaves above the water. The mined leaves turn yellow, remain on the surface of the water and eventually decompose. Eggs were laid singly or in groups of 2–10 on the leaves, usually natant ones, during the second half of May, and the larvae hatched in 2–3 days and became full-fed in about a week. They pupated in their mines, and the pupal stage also lasted about a week. Adult emergence began in the first half of June, but the females did not become sexually mature for a week, and though they oviposited on rice, the second-generation larvae were mostly unable to complete their development on the rapidly maturing crop. In the laboratory, the females also oviposited on wheat and barley and, less readily, on oats, and in a test on barley, showed a distinct preference for leaves that were horizontal. In the laboratory at 100 per cent. relative humidity, the duration of the egg stage ranged from 14 days at 8·5°C. [47·3°F.] to 1·5 days at 33°C. [91·4°F.]. No eggs hatched at 35°C. [95°F.]. At 25°C. [77°F.], the larval stage lasted 8–10 days on barley and 7–8 days on rice. The pupal stage ranged from six days at 30°C. [86°F.] to 15 days at 11°C. [51·8°F.]. Emergence was normal from floating pupae, but pupae kept under water for 7–12 days did not give rise to adults. The parasites of *H. griseola* are reviewed from the literature. In addition to those already mentioned [*loc. cit.*], they include *Ademon decrescens* (Nees), which was observed on several occasions in 1953 and 1954. In 1955, 71 per cent. of the pupae of the first generation of *H. griseola* were parasitised, the commonest parasite being *Opius punctiventris* Thoms. More than 10 per cent. of the parasitised pupae were also attacked by a hyperparasite, *Chrysocharis* sp.

Since *H. griseola* develops only on young plants and cannot complete its development on rapidly maturing rice, the severity of attack can be reduced by cultural practices designed to produce strong plants and to accelerate

growth. If severe infestation is feared, draining the fields for 2–4 days and mixing DDT with the next flood water is recommended. This should be done about mid-May, before eggs are laid.

Couturier (A.) & Robert (P.). **Observations sur *Melolontha hippocastani* F.**—*Ann. Épiphyt.* **7** no. 3 pp. 431–450, 10 figs., 15 refs. Paris, 1956.

Considerable damage was caused in forest nurseries and young plantations to the north of Strasbourg in 1951–52 by larvae of *Melolontha hippocastani* F., and large populations of adults were observed in 1954 in mixed forests in the area. An account is given of investigations carried out in 1954 on the emergence of the adults from the soil, the preoviposition and oviposition flights and the factors inducing them, and the influence of the soil on the distribution of infestation. The life-cycle lasted four years. In comparison with *M. melolontha* (L.), the adults emerged on the soil surface at a somewhat lower ground temperature, the first males appearing several days before the females, and flew to the nearest trees for feeding [*cf. R.A.E.*, A **42** 354]. The females oviposited in open soil near the feeding sites. Flight appeared to be induced not only by a reduction in the intensity of the light, but also by an increase in its degree of polarisation, such as takes place in the evening [*cf.* **45** 117].

Davatchi (A.), Zahedi (K.) & Mirchah-Valad (E.). **The Effect of some new Insecticides on *Sitophilus* (*Calandra*) *granaria* L., and *Trogoderma granarium* Everts.** [*In Persian.*]—*Bull. Lab. appl. Ent. Fac. Agric. Karadj* no. 6 pp. *1–16*, 2 figs., 6 graphs, 16 refs. Karadj, 1955. (With a Summary in English, pp. 1–6.)

An account is given of tests in Persia in which complete mortality of *Calandra* (*Sitophilus*) *granaria* (L.) was obtained within six days when adults were placed in groups of ten in 20 gm. stored wheat treated with parathion or γ BHC at rates of 1–5 parts per million, or with DDT at 0·005–0·05 per cent. As parathion and DDT at these rates exceed the limits of tolerance when the grain is to be used for human or animal consumption, γ BHC at 1 p.p.m. is recommended. None of the treatments gave complete kill of adults of *Trogoderma granarium* Everts even after 30 days, the best being DDT at 0·01–0·02 per cent., which gave 93 per cent. mortality. DDT at 0·01 per cent. is recommended if the grain is to be used for sowing, and γ BHC at 2 p.p.m., which gave 83 per cent. mortality, if it is to be used for consumption.

Papers noticed by Title only.

Nizamlioglu (K.). **Türkiye meyve ağacı zararlıları ve mücadelesi.** [Pests of Fruit Trees in Turkey and their Control.]—*Koruma Tarım İlâçları A.Ş. Neşr.* no. 5, 208 + viii pp., 159 figs., 88 refs. [Istanbul] 1957.

Pond (D. D.). **Annotated List of Insects found in or near Roots of cultivated Crucifers in New Brunswick.**—*J. econ. Ent.* **49** no. 3 pp. 336–338, 20 refs. Menasha, Wis., 1956.

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